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THE PUBLISHED WORKS OF FERDINAND J. H. MUELLER (1825–1896). SUPPLEMENT

by

D. M. Churchill, T. B. Muir and D. M. Sinkora*

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INTRODUCTION

This paper supplements those of Churchill, Muir & Sinkora (1978) and Muir (1979), and constitutes the third and final part envisaged when they were prepared. It follows the same format as those papers and they should be consulted for all necessary explanations.

Some publishing dates listed in the 1978 bibliography have been amended and printing errors corrected in this supplement. An article by Barnard (1899) on publications of the *Southern Science Record* should be noted, especially his comment concerning volume 3 (1883): ". . . the later numbers of that volume . . . did not appear till some months after the months named on their covers, consequently several were not issued until well on in 1884." Barnard omits mention of the May 1885 issue.

Mueller's official reports tabled in Parliament often contain, in addition to the reports proper, other papers which have been referred to separately in literature and are frequently sought by researchers. For this reason we are listing the major contents of each report under the reference number published in the 1978 bibliography.

The number of additional publications found since 1978 is relatively small. As noted then, minor publications or reprints were published in overseas journals not available for scanning here, and in Australian newspapers. The *Sydney Mail*, for instance, reprinted part or all of some of F. Mueller's early issues of the "Select extra-tropical plants . . ." in serial form in somewhat irregular weekly instalments over a number of years. The instalments did not always follow the strict alphabetical order of the original, but at times were rearranged to fit into the available space. Probably "Introduction to botanic teachings . . ." (77.13.07) and possibly other publications were reprinted in the same way. Because these papers have no taxonomic significance we have not searched exhaustively for them, having decided that the material gained would not warrant the present cost of recovery.

Two publications listed in 1978 (op. cit.): 73 under 1858-59 as being no longer in existence in Australian libraries have now been located and are parts of the one paper. See 59.06.02.

Mueller's enormous output, long known or guessed at in scientific circles, has attracted attention from another source. Carr & Carr (1981 : 135) comment that "In his book *Little Science, Big Science*, Columbia Univ. Press, 1963, D. J. de Solla Price records Sir George Caley, a British mathematician of the 19th century, as having '995 items in his collected works — a paper every 2-3 weeks — and I have failed to find anyone who outstrips this'. Mueller may thus have published more papers, including books, than any other scientist."

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* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria 3141.

Muelleria 5(4): 229-248 (1984).

Two facsimile reprints of F. Mueller publications have been published in recent years. These are:

Fragmenta Phytographiae Australiae. Vols 1-12 & plates, published in three volumes. (A. Archer & Co., B.V. : Amsterdam). 1974.

Descriptive notes on Papuan plants. Parts 1-9, published in one volume (with a new index to parts 6-9 added). (Boerhaave Press : Leiden). 1979.

Two more or less biographical works published recently are:

Veitch, Anthony Scott. Roses and Boronia: a mid-Victorian romance. (Australian Broadcasting Commission : Sydney). 1981. First broadcast as a radio serial in 1980, this is a light-hearted romantic novel woven around the courtship and engagement of Dr. Ferdinand Mueller and Euphemia Henderson.

Kynaston, Edward, A man on edge. (Penguin — Alan Lane : Melbourne). 1981. Although based on a great deal of research it contains too much that is the author's surmise and theory to be called a factual biography. Lacking citations for the sources of information, at best it will frustrate any serious researcher, at worst it will lead to errors being taken at face value for fact.

Stafleu & Cowan (1981 : 616-617) supply many additional biographical references not listed in Churchill, Muir & Sinkora (1978 : 13-14).

Acquisition of photocopies of F. Mueller correspondence lodged in other institutes continues as funds permit. Most of the manuscript collection is not yet catalogued and the listing of it, as tentatively suggested in the introduction to the 1978 bibliography, is not yet possible.

Several photographs (Figs 1-7) are included to portray examples of Mueller's places of residence and some of his achievements within the Royal Botanic Gardens.

ACKNOWLEDGEMENTS

Our sincere thanks go again to the many people and institutes who assisted in various ways in the tracing and supplying of information. In addition special appreciation is due to

Fig. 1. The Mönchentor, an old customs gate near the harbour in Rostock, East Germany. Mueller was born in the dwelling above the gate, where the family lived until after the father's death. The original is in the possession of Mrs Beryl Arthur, Adelaide, a descendant of Mueller's sister Clara. Photo by Mr Ralph Grandison, Adelaide.

Fig. 2. The house of Mueller's maternal grandparents in Tönning to which his mother returned with her children after the death of his father in 1835. By Husum porcelain painter Sass after a drawing (about 1850) by Mueller's cousin Ferdinand Mertens, the cup is still in the possession of the Mertens family. Photo by Dr G. Klatt, Husum.

Miss Helen Cohn, Librarian, Royal Botanic Gardens and National Herbarium, Victoria, for her assistance and advice.

Mr R. Articus, Hamburg, West Germany, scanned volumes of a German journal, supplied references and photocopies of biographical material and of Mueller articles.

Australian Biological Resources Study. The bibliography of Churchill, Muir & Sinkora (1978) was financed by grants 1974-1977. The present work, although not funded, is a continuation and direct result of the basic work carried out under the grant.

Australian Botanical Liaison Officers in London, Mr Bruce Maslin, Dr Rod J. Henderson, Dr A. A. Munir and Mr Rex Filson searched for material and supplied photocopies.

Australian National Library, Canberra, supplied photocopies.

Bibliothèque du Conservatoire botanique, Geneva, Switzerland. Mr H. M. Burdet photocopied F. Mueller correspondence from the archives.

British Library, Lending Division, Wetherby, Yorkshire, U.K., supplied photocopies.

Mrs Joan Creighton, Balga, Western Australia, a descendant of F. Mueller's sister Clara Wehl, sent photocopies of manuscript material in the family's possession.

D.S.I.R., Botany Division, Christchurch, New Zealand. Dr M. J. Parsons supplied references to manuscript material in New Zealand.

Mr P. F. Fox, Mont Albert North, Victoria, supplied references to F. Mueller publications and manuscript material found during his own research.

Mr Ralph Grandison, Adelaide, South Australia, contributed photographs and photocopies of Mueller correspondence found in the course of his own research.

Ms Linda Harrison, Bathurst, New South Wales, supplied photocopies of manuscript material in the family's possession.

Mr C. G. Hocking, Department of Botany, La Trobe University, Bundoora, Victoria, supplied copies of Mueller letters owned by his family.

Institut für Allgemeine Botanik & Botanischer Garten, Hamburg, West Germany. Dr Ingeborg Friedrichsen and Dr Paula Wiemann obtained and sent photocopies of Mueller correspondence not only from Hamburg, but also from the archival holdings of institutes in other parts of Germany.

Dr Günter Klatt, Husum, West Germany, present owner of the pharmacy where Mueller was apprenticed as a boy, supplied biographical information and photographs. Some of these are reproduced here with his permission.

Mr Darrel Kraehenbuehl, Adelaide, South Australia, supplied references to Mueller publications and biographical articles found during his own research.

Missouri Botanic Garden, St. Louis, Missouri, U.S.A. The Library supplied photocopies.

Mitchell Library, Sydney, New South Wales, supplied photocopies of Mueller articles and correspondence.

Monash University, Department of Geography, Clayton, Victoria. Dr J. M. Powell supplied references to biographical material. Mr Ray Wright supplied photocopies of archival material found during his own research.

National Museum of Victoria, Melbourne. Dr T. Darragh supplied references.

Mr Gaston Renard, Antiquarian, Prahran, Victoria, gave information on a rare Mueller publication.

Dr D. L. Serventy, Nedlands, Western Australia, sent photocopies and references of material of biographical interest.

State Library of South Australia, Newspaper Section, Adelaide, provided photocopies. Mr Marquis gave valuable assistance during a visit by one of the authors in the search for and recovery of material.

State Library of Victoria, especially the La Trobe Section, supplied photocopies. The staff gave advice and assistance during much of the research carried out there.

Taxon, Utrecht, Netherlands. The editor published a request for information in *Taxon* 25:272 (May 1976). We apologise that this acknowledgement was overlooked in the 1978 bibliography.

Uebersee-Museum, Bremen, West Germany. Mr Heinrich Kuhbier supplied photocopies of archival material.

Mr Friedrich Ueck, Silberstedt, West Germany, placed a notice in a local historical journal appealing for information about F. Mueller or descendants of his family.

University of Adelaide, Barr Smith Library. Miss M. W. Rooney, Special Collections Librarian, supplied photocopies of F. Mueller correspondence.

University of London, Chelsea College, Centre for Science Education, London, U.K. Professor A. M. Lucas provided references to Mueller publications.

University Library of Lund, Sweden, supplied photocopies of Mueller correspondence.

University of Porto, Instituto de Botânica "Dr. Gonçalo Sampaio", Faculdade de Ciencias, Porto, Portugal. Professor Dr R. Salema, Director, supplied photocopies.

University of Sydney, Department of Geology & Geophysics. Dr David Branagan supplied references to F. Mueller publications.

Dr J. H. Willis, Brighton, Victoria, former Assistant Government Botanist at this Herbarium, now retired, over many years collected information and data which proved invaluable in the compiling of the bibliography. We apologise for the inadvertent omission of his name from the acknowledgements in 1978.

Mr Paul Wilson, Western Australian Herbarium, supplied several additions to the taxonomic index.

Fig. 3. The market place in Husum at the time of Mueller's residence there. The first building on the left past the church is the pharmacy where he was apprenticed from 1840–45. It was rebuilt in 1862. Old engraving (Anon.). Photo by Dr G. Klatt, Husum.

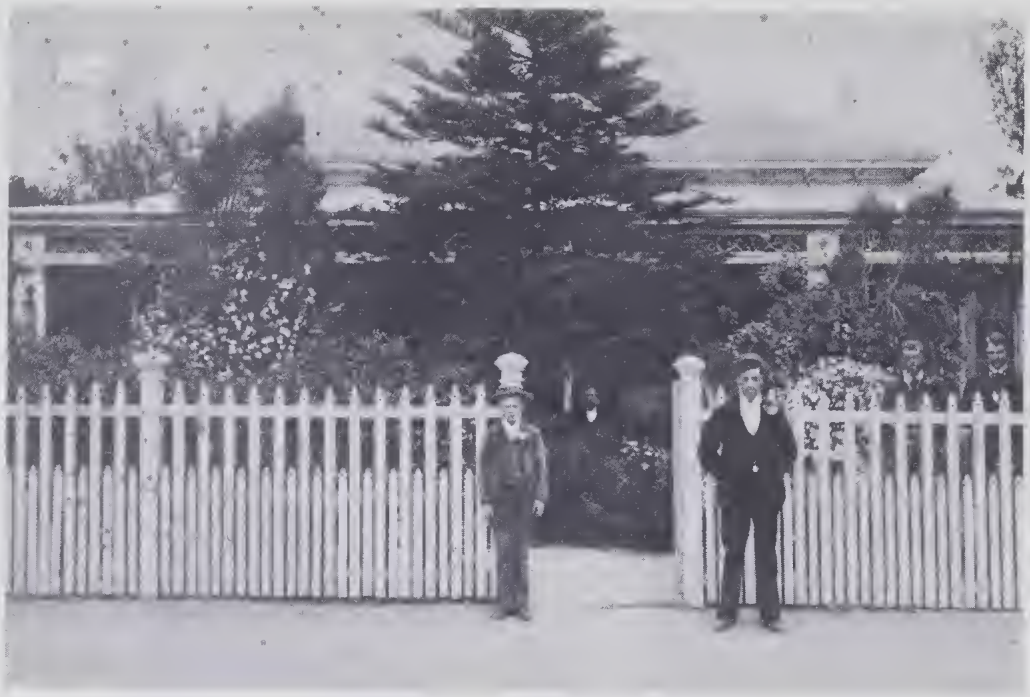

Fig. 4. Mueller's modest house at 28 Arnold Street, South Yarra, where he lived from the time he left the Director's residence in the Botanic Gardens in 1873 until his death in 1896. From left to right: George Parncutt, Mueller seated on the verandah, George French, Charles French jr., and J. S. Lyng, Mueller's cook and valet. Photographed in December 1894. The house was pulled down in 1963 to make room for a block of flats. Photo Royal Botanic Gardens collection.

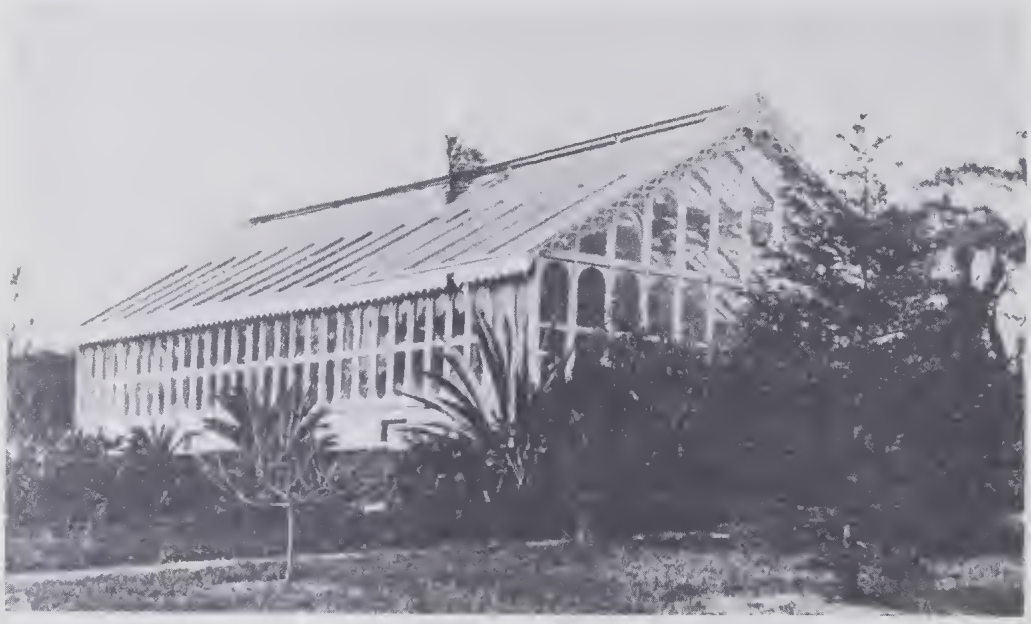

Fig. 5. The palmhouse which was constructed in 1858. Photo Royal Botanic Gardens collection.

Fig. 6. Mueller's "Pinetum" planted in 1858 from seed he obtained from all parts of the globe. Mueller brought together the plants which were later used by W. R. Guilfoyle to landscape the Royal Botanic Gardens as they are known today. Photo Royal Botanic Gardens collection.

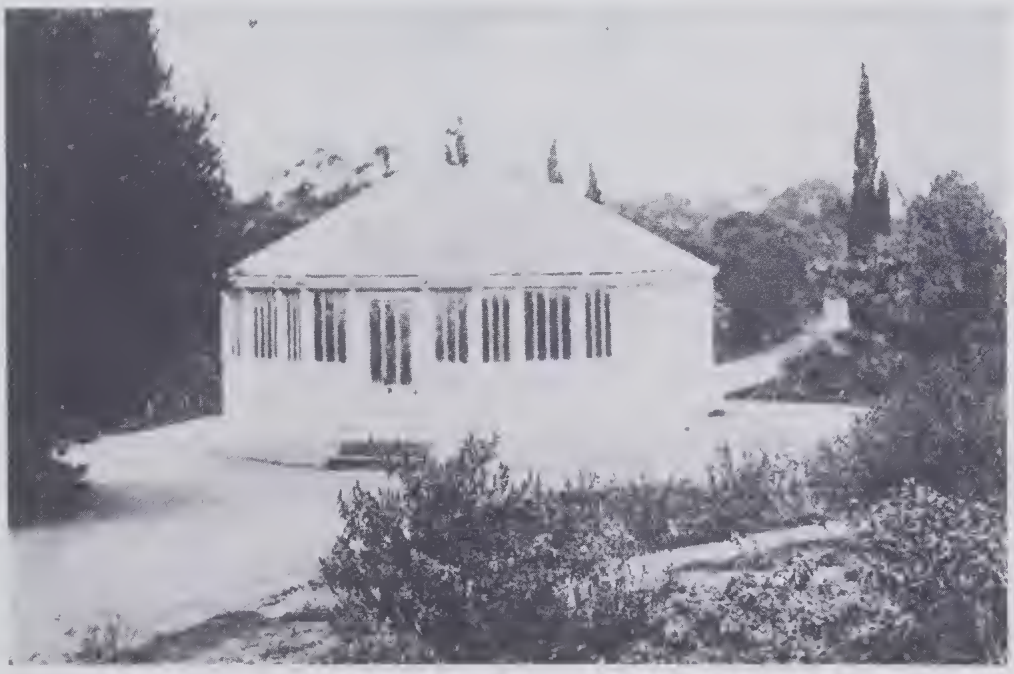

Fig. 7. The Conservatory "was erected by labour and from material available at the gardens." (Mueller's annual report dated 10 March 1862, p. 3). Photo Royal Botanic Gardens collection.

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1848

48.09.01 Mueller, F. [Advertisement] *South Australian Register* **12** (871) : 2. [20 September]

1853

53.10.01 contains: Report pp. 3-7; Systematic index of the plants of Victoria, which were collected and examined between September, 1852, and August, 1853, pp. 9–22.

1854

54.05.01 Mueller, F. The medicinal plants of Australia. *Pharm.J.Trans.* **13** (11) : 616–618. [1 May] [extracted from 53.10.01 by P. L. Simmonds]

54.10.01 contains: Report pp. 3–7; Second systematic index of the plants of Victoria, comprising those which were examined between September, 1853, and October, 1854, pp. 9–20.

54.12.01 Mueller, F. First general report of the Government Botanist on the vegetation of the Colony, dated September 1853. Enclosure 1 *in* Dispatch No. 5. *In* Further papers relative to the discovery of gold in Australia. (In continuation of papers presented February 14, 1854.) Presented to both Houses of Parliament by command of Her Majesty, December 1854 : 95–98. (G. E. Eyre & W. Spottiswoode : London). [tabled 22 December] [A facsimile reprint was published in 1969 *in* Irish University Press Series of British Parliamentary Papers. Correspondence and papers relating to constitutions, the discovery of gold, and other affairs in Australia, 1854–55. Colonies. Australia. **20.** (Irish University Press : Shannon, Ireland).] [see also 53.10.01, 54.13.02]

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1855

55.11.01 contains: Report pp. 3–6; Third systematic index of the plants of Victoria, comprising those collected and examined between November, 1854, and June, 1855, pp. 7–12.

55.13.03 p. 5–24 was published between 18 September & 22 November 1854; p. 34–50 was published between 6 September & 13 September 1855. [ref. H. I. Aston (1984)]

55.13.04 was published between 6 September & 13 September 1855. [ref. H. I. Aston (1984)]

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1856

56.13.08 Mueller, F. Die Flora der australischen Provinz Victoria und ihre Anwendung in der Medicin. *Arch. Pharm. (Hannover)* ser. 2, **86** : 98–102. [German translation by Hellft of the major part of 53.10.01]

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57.09.01 contains: Report only.

57.09.02 Mueller, F. The Botanic Garden. *Argus, Melbourne* No. 3518 : 5. [19 September] [see also 57.09.01]

57.13.08 line 2: delete: 200; replace with: 199

1858

58.11.02 contains: Report pp. 3–9; Fourth systematic index of the plants of Victoria, comprising those collected and examined in 1857 and 1858 pp. 11–13; Catalogue of plants under cultivation in the Melbourne Botanic Garden pp. 15–27.

58.13.01 was published between 23 September & 30 September 1857. [ref. H. I. Aston (1984)]

58.13.02 was published between 23 September & 30 September 1857. [ref. H. I. Aston (1984)]

58.13.03 was published between 5 May & 26 May 1858. [ref. H. I. Aston (1984)]

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1859

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59.07.02 _____ Exploration of the interior. *Herald, Melbourne* **59** (4209) : 5. [22 July]

59.08.01 _____ [Letter] *In* Exploration des Innern. *Deutsche Monatsschrift für Australien (Melbourne & Sydney)* No. 4 : 184. [August]

59.10.02 contains: Report pp. 3–4; Description of the localities from which specimens of plants were obtained during the South Australian northern expedition pp. 5–6; Enumeration of the plants collected pp. 7–21.

59.11.02 Mueller, F. South Australian botany. *Adelaide Observer* : 6. [5 November] [see also 59.04.02, 59.10.02 (report only)]

59.13.01 was published between 23 June & 13 July 1859. [ref. H. I. Aston (1984)]

59.13.02 was published between 23 June & 13 July 1859. [ref. H. I. Aston (1984)]

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1860

60.01.01 contains: Report pp. 3–10; Fifth systematic index of the plants of Victoria, comprising those collected in 1859 p. 11; Catalogue of the plants added during 1859 to those under cultivation in the Melbourne Botanic Garden pp. 12–16.

60.13.04 was published between 30 November & 21 December 1859. [ref. H. I. Aston (1984)]

60.13.05 was published between 4 June & 25 June 1860. [ref. H. I. Aston (1984)]

60.13.06 was published between 4 June & 25 June 1860. [ref. H. I. Aston (1984)]

60.13.07 was published between 4 June & 25 June 1860. [ref. H. I. Aston (1984)]

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60.13.09 was published between 4 June & 25 June 1860. [ref. H. I. Aston (1984)]

60.13.13 Mueller, F. Notes on South Australian plants. (Mason & Firth : Melbourne) [see also 60.13.05]

60.14.04 was published between 4 June & 25 June 1860. [ref. H. I. Aston (1984)]

1861

61.02.01 contains: Report pp. 3–15; Sixth systematic index of the plants indigenous to the Colony of Victoria, comprising those phaenogamous species collected during the year 1860, and a list of fungi examined by the Rev. M. J. Berkeley, F.R.S. pp. 17–18.

1862

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62.05.02 Mueller, F. Zierden Melbourne's. 2. Der botanische Garten. *Australische Monatszeitung (Melbourne)* No. 4 : 39–40. [20 May] [German translation of extracts from 62.03.01]

1863

63.05.01 contains: Report pp. 3–9; Enumeration of the plants collected during Mr. J. MacD. Stuart's expeditions across the Australian continent in 1860, 1861 and 1862 pp. 11–15; Enumeration of the plants collected by Dr. J. Murray during Mr. A. Howitt's expedition into central Australia in the year 1862 pp. 16–18.

1864

64.13.05 Mueller, F. Enumeration of the plants collected during Mr. J. McDouall Stuart's expeditions across the Australian continent in 1860, 1861 and 1862. Appendix. *In* W. Hardman (Editor), Explorations in Australia. The journals of John McDouall Stuart during the years 1858, 1859, 1860, 1861, & 1862, when he fixed the centre of the continent and successfully crossed it from sea to sea : 493–507. (Saunders, Otley & Co. : London). [also published in F. Mueller's Annual Report, see 63.05.01; see also 65.13.09]

1865

65.10.01 contains: Report pp. 3–13; [lists of contributors of plants and seeds] pp. 15–17; Index of eminently valuable, conspicuous or rare plants specially numbered on the plan pp. 17–18; Catalogue of the library of the Botanical Department, Melbourne pp. 18–23; Plan of the Government House Reserve, Botanic Garden and its Domain, indicating the principal plantations [map].

65.13.09 Mueller, F. Enumeration of the plants collected during Mr. J. McDouall Stuart's expeditions across the Australian continent in 1860, 1861 and 1862. Appendix. *In* W. Hardman (Editor), Explorations in Australia. The journals of John McDouall Stuart during the years 1858, 1859, 1860, 1861, & 1862, when he fixed the centre of the continent and successfully crossed it from sea to sea : 493–507. Second Edition. (Saunders, Otley & Co. : London). [also published in F. Mueller's Annual Report, see 63.05.01; see also 64.13.05] [A facsimile edition was published in 1975 (Libraries Board of South Australia : Adelaide).]

1866

66.04.05 _____ Lecture on Australia. *Primitive Methodist Magazine* (London) new ser., **4** : 201–209. [April]

66.10.02 _____ Notes. *In* A. Everett, Victoria — Distribution of forest trees. [Map] (State Forest Board : Melbourne). [24 October] [not seen; see also 69.01.02]

1867

67.02.03 _____ On the cultivation of the Cinchona in the South of Europe. *In* The International Horticultural and Botanical Congress, held in London, from May 22nd to May 31st, 1866. Report of Proceedings : 23. (Truscott, Son, & Simmons : London). [February] [ref. *Gard.Chron.* 1867 : 154. (16 February) ". . . has just been issued . . ."] [see also 66.06.01]

67.13.07 _____ Products of dry distillation of Victorian woods. *In* Intercolonial Exhibition of Australasia, Melbourne, 1866–67. Official record, containing introduction, catalogues, reports, . . . essays, ... : 238–243. (Blundell & Co. : Melbourne).

67.13.08 _____ Paper materials. Gums. Picric Acid. . . . etc. *In* Notes on the vegetable products in the Intercolonial Exhibition of 1866. *In* Intercolonial Exhibition of Australasia, Melbourne, 1866–67. Official record, containing introduction, catalogues, reports, . . . essays, . . . : 243–258. (Blundell & Co. : Melbourne).

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67.13.10 _____ Appendix. *In* Notes on the vegetable products in the Intercolonial Exhibition of 1866. *In* Intercolonial Exhibition of Australasia, Melbourne, 1866–67. Official record, containing introduction, catalogues, reports, . . . essays, . . . : 263–264. (Blundell & Co. : Melbourne)

1868

68.13.03 _____ [Letter] *In* J.-L. Soubeiran & A. Delondre, De l'introduction et de l'acclimatation des Cinchonas dans les Indes Néerlandaises et dans les Indes Britanniques : 157–158. (Victor Masson et Fils : Paris). [see also 68.06.02]

1869

69.01.02 _____ Notes. *In* A. Everett, Victoria — Distribution of forest trees. [Map] Revised & corrected. (State Forest Board : Melbourne). [15 January] [see also 66.10.02] [A facsimile edition in reduced size was published in 1978 (Forests Commission of Victoria : Melbourne).]

69.07.03 contains: Report [dated 14 September, 1868] pp. 3–8; Supplementary Report [dated 8 March, 1869] pp. 9–13; [miscellaneous tables of chemical analyses of plants] pp. 14–15; Supplemental list of works contained in the botanical library pp. 16–17; [lists of contributors of plants and seeds] pp. 17–21; Plan of the Government House Reserve, Botanic Garden and its Domain, indicating the principal plantations [map].

1872

72.09.03 Mueller, F. Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (636) : 295. [7 September] [see also 72.13.02, *Acacia farnesiana — Andropogon avenaceus*]

72.09.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (637) : 328. [14 September] [see also 72.13.02, *Andropogon bicolor — Apocynum cannabinum*]

72.09.05 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (638) : 360. [21 September] [see also 72.13.02, *Arachis hypocaea — Avena fatua*]

72.09.06 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (639) : 390. [28 September] [see also 72.13.02, *Avena flavescens — Barosma serratifolia*]

72.10.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (640) : 424–425. [5 October] [see also 72.13.02, *Beta vulgaris — Caesalpinia gilliesii*]

72.10.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (642) : 486. [19 October] [see also 72.13.02, *Cajanus indicus — Capparis spinosa*]

72.11.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (645) : 582–583. [9 November] [see also 72.13.02, *Capsicum annuum — Cichorium endiva*]

72.11.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (646) : 615. [16 November] [see also 72.13.02, *Cicer arietinum — Cinchona officinalis*]

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72.12.01 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (649) : 713. [7 December] [see also 72.13.02, *Colchicum autumnale — Crataegus parviolius* [sic]]

72.12.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (651) : 775. [21 December] [see also 72.13.02, *Crataegus pyracantha — Digitalis purpurea*]

72.12.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **14** (652) : 808. [28 December] [see also 72.13.02, *Discorea aculeata — Fagopyrum emarginatum*]

72.13.02 was published prior to 11 November 1872 [ref. *Trans. & Proc. Roy.Soc.Victoria* **10** : 215 (1873)], probably prior to 7 September 1872 [ref. commencement of reprint in *Sydney Mail*, 72.09.03]

72.14.02 Mueller, F. & R. D. Fitzgerald. [Description of *Dendrobium fairfaxii*] *In* [Anonymous] Flora of Australia. *Sydney Mail* new ser., **14** (No. 638) : 360, pl. [21 September]

1873

73.03.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **15** (664) : 361. [22 March] [see also 72.13.02, *Fagopyrum esculentum — Foeniculum officinale*]

73.04.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **15** (667) : 455. [12 April] [see also 72.13.02, *Fourcroya cubensis — Glycyrrhiza glabra*]

73.04.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **15** (668) : 488. [19 April] [see also 72.13.02, *Gossypium arboreum — Hedeoma pulegioides*]

73.06.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **15** (677) : 775. [21 June] [see also 72.13.02, *Hedysarum coronarium — Hovenia dulcis*]

73.06.05 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **15** (678) : 807. [28 June] [see also 72.13.02, *Hordeum hexastichan — Humulus lupulus*]

73.07.05 _____ The plants of Riverina. *Sydney Mail* new ser., **16** (681) : 72. [19 July]

73.07.06 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **16** (682) : 104. [26 July] [see also 72.13.02, *Hydrastis canadensis — Ipomaea paniculata*]

73.09.03 _____ On poisonous plants. *Sydney Mail* new ser., **16** (688) : 294, 2 plates. [6 September] [see also 73.07.01, 73.07.02, 73.13.03, 73.13.04]

73.09.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **16** (689) : 327. [13 September] [see also 72.13.02, *Ipomaea purga — Justicia adhatoda*]

73.09.05 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **16** (690) : 363. [20 September] [see also 72.13.02, *Kentia baueri — Lolium perenne*]

73.09.06 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **16** (691) : 400. [27 September] [see also 72.13.02, *Lupinus albus — Maranta arundinacea*]

73.09.07 _____ Dr. Mücke und die Linné-Societät. *Australische Deutsche Zeitung, Tanunda (S.A.)* **11** (No. 38) : 5. [18 September 1873]

73.10.01 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **16** (692) : 432. [4 October] [see also 72.13.02, *Matricaria chamomilla — Mentha viridis*]

1874

74.01.01 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **17** (705) : 7. [3 January] [see also 72.13.02, *Menyanthes trifoliata — Musa paradisiaca*]

74.02.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **17** (713) : 272. [28 February] [see also 72.13.02, *Musa sapientum — Nicotiana tabacum*]

74.05.02 _____ Additions to the lists of the principal timber trees and other select plants, readily eligible for Victorian industrial culture. (Stillwell & Knight : Melbourne) [May ?] [see also 74.13.06]

74.05.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **17** (725) : 654–655. [23 May] [see also 72.13.02, *Olea europaea — Ocimum sanctum*]

74.07.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (732) : 39. [11 July] [see also 72.13.02, *Onobrychis sativa — Opuntia tuna*]

74.07.03 _____ Timber trees and other plants eligible for Australian culture. *Sydney Mail* new ser., **18** (733) : 69. [18 July] [see also 74.05.02 and 74.13.06, *Aberia caffra — Acacia pycnantha*]

74.07.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (733) : 71. [18 July] [see also 72.13.02, *Opuntia vulgaris — Paliurus ramosissimus*]

74.07.05 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (734) : 102–103. [25 July] [see also 72.13.02, *Oxalis crassicaulis — Papaver somniferum*]

74.09.01 contains: Report pp. 3–10; Appendix. Seventh systematic index of the plants indigenous to the Colony of Victoria pp. 11–12; Additions to the genera of plants of Australia since the issue of the last Report p. 12; Fossil genera hitherto here defined p. 12; Index of collection of vegetable products sent to the last London Exhibition p. 13; [list of chemical analyses; working expenses of the Department of the Government Botanist] p. 14.

74.09.03 Mueller, F. Timber trees and other plants eligible for Australian culture. *Sydney Mail* new ser., **18** (741) : 325–326. [12 September] [see also 74.05.02 and 74.13.06, *Achras sapota — Anthistiria avenacea]* [some species were omitted from this reprint]

74.09.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (743) : 392. [26 September] [see also 72.13.02, *Paspalum distichum — Passiflora quadrangularis*]

74.10.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (744) : 423. [3 October] [see also 72.13.02, *Passiflora serrata — Phaseolus coccineus*]

74.10.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (745) : 455. [10 October] [see also 72.13.02, *Parinarium nonda — Phaseolus vulgaris*]

74.10.04 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (748) : 551. [31 October] [see also 72.13.02, *Phaseolus lunatus — Phoenix reclinata*]

74.11.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **18** (749) : 583. [7 November] [see also 72.13.02, *Phoenix dactylifera — Physalis alkekengi*]

74.11.03 _____ Timber trees and other plants eligible for Australian culture. *Sydney Mail* new ser., **18** (751) : 646. [21 November] [see also 74.05.02 and 74.13.06, *Aponogeton distachyon — Gonioma kamassi*] [*Azima tetracantha — Ficus rubiginosa* and some other species were omitted from this reprint]

74.11.04 _____ Timber trees and other plants eligible for Australian culture. *Sydney Mail* new ser., **18** (752) : 678–679. [28 November] [see also 74.05.02 and 74.13.06, *Guilandina bonduc — Heleocharis tuberosa*]

74.12.02 _____ Timber trees and other plants elibible for Australian culture. *Sydney Mail* new ser., **18** (756) : 806–807. [26 December] [see also 74.05.02 and 74.13.06, *Gunnera chilensis — Laserpitium aquilegium*]

1875

75.03.02 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **19** (767) : 326. [13 March] [see also 72.13.02, *Physalis angulata — Pringlea antiscorbutica*]

75.03.03 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **19** (768) : 359. [20 March] [see also 72.13.02, *Prosopis dulcis — Psidium arboreum*]

75.05.06 _____ Plants eligible for Australian culture. *Sydney Mail* new ser., **19** (775) : 585. [8 May] [see also 72.13.02, *Psidium araca — Ptychosperma elegans*]

1876

76.06.02 delete existing entry; replace with:
Mueller, F. Select textile plants deserving extensive culture in the Colony of Victoria. *In* An educational lecture on the food of plants in its relations to the exhaustion of lands, and on scientific farming generally, together with analyses of manures, by R. W. E. M'Ivor, Esq. Agricultural Chemist. Also, Select textile plants deserving extensive culture in the Colony of Victoria, a lecture given in Ballarat before the Farmers' Club, 27th May, 1876 : 17–40. (Ballarat Star Office : Ballarat). [7 June] [ref. *Ballarat Star* (7 June 1876) : 3 "This day is published . . ."] [see also 76.05.01, 76.05.02, 76.05.03]

76.13.10 _____ Description of fossil plants from the Upper Tertiary auriferous drifts of New South Wales. *In* C. S. Wilkinson, Report of progress of the Geological Survey of New South Wales. Appendix : 12–14, plates 1 & 2. (Government Printer : Sydney). [see also 76.13.01]

1879

79.05.02 _____ The flora of Australia. *Western Star & Roma Advertiser, Roma* (Queensland) : 4. [12 May] [see also 76.04.02]

79.13.08 was published before 25 June 1879. [ref. *Proc.Linn.Soc.N.S.W.* 4 : 313. (1880)]

1880

80.11.01 Mueller, F. *Fragm. Phyt. Austr.* **11**, Supplement : 1–42. [November]

80.13.04 was published before 28 April 1880. [ref. *Proc.Linn.Soc.N.S.W.* **5** : 185. (1881)]

1881

81.03.01 was published after 7 April 1881. [ref. T. B. Muir 1981 : 386]

81.08.02 was published after 9 September 1881. [ref. T. B. Muir 1981 : 386]

81.13.02 delete: Supplement : 1–132.

81.13.12 Mueller, F. *Fragm. Phyt. Austr.* **11**, Supplement : 43–132. [Evidence from the gatherings and binding suggests that this may have been published in three separate fascicles, viz. pp. 43–74, 75–104 and 105–132, with the last fascicle published after 2 November 1881, and possibly not until early 1882. (see note to 82.13.08 below)]

81.14.01 _____ & O. W. Sonder. [Description of *Caulerpa novo-ebudarum] In* O. W. Sonder, Algae of the New Hebrides, collected by F. Campbell, Esq. *Pap. & Proc. Roy. Soc. Tasmania* 1880 : 14.

1882

82.03.02 [Stafleu & Cowan 1981 : 623, No. 6423, have confused two entries. 82.03.02 contains publication of *Phyllanthus tatei* F.Muell., *Spartothamnus teucriiflorus* F.Muell., *Lyperanthus forrestii* F.Muell., while *Hicksbeachia pinnatifolia* F.Muell. and *Helipterum frenchii* F.Muell. were published in 83.02.02]

82.05.01 delete: 100; replace with: 4. [the first issue (May 1882) of vol. 5 was erroneously paged 97–104, instead of 1–8]

82.10.01 Line 2, delete: 229. [October]; replace with: **5** : 48. (15 October]

82.13.08 was published late in 1881, after 2 November 1881. [ref. 81.13.12 : 121; the paper was read on 2 November 1881.]

82.13.18 Mueller, F. A glance on the plants of Tasmania. *In* Guide to excursionists between Australia and Tasmania. (H. Thomas : Melbourne). [see also 70.13.01, 83.04.05, 84.13.13, 85.01.02, 85.03.02, 86.13.03] [Distributed in the form of galley proofs by the author, but no 1882 edition of the "Guide" appears to have been published.]

82.13.19 _____ On *Dysoxylon schiffneri* (Section Cleisocalyx), a new tree from East Australia. *Trans. Bot. Soc. Edinburgh* **14** (3) : 369–371. [see also 81.11.02, 82.03.03]

1883

83.04.07 _____ Diagnoses of a new genus and species of Verbenaceae from Arnheim Land. [Preprints distributed by the author in the form of proof sheets without pagination. In his letter to Ralph Tate, Adelaide, of 27 April 1883 F. Mueller acknowledged receipt of these preprints.] [see also 83.12.04]

83.13.09 _____ [Introduction] *In* W. Mitten, Record of new localities of Polynesian mosses, with descriptions of some hitherto undefined species. *Proc. Linn. Soc. New South Wales* **7** : 98–99.

83.13.10 _____ [Note] *In* W. Macleay, On a species of *Galaxias* found in the Australian Alps. *Proc. Linn. Soc. New South Wales* **7** : 106.

83.13.11 _____ [Introduction] *In* C. Kalchbrenner, New species of *Agaricus* discovered in West Australia. *Proc. Linn. Soc. New South Wales* **7** : 638.

1884

84.01.04 _____ Botanic Gardens. *Leader, Melbourne* No. 1466 : 13. [26 January] [see also 83.12.01]

84.07.02 delete p. ref.: 3; replace with: 5.

84.13.16 was published before 10 March 1884. [ref. *Victorian Naturalist* **1** : 23 (March 1884)]

84.13.22 Mueller, F. Select extra-tropical plants readily eligible for industrial culture or naturalization, with indications of their native countries and some of their uses. American edition, revised and enlarged. (George S. Davis : Detroit, Mich.) [see also 76.13.03, 80.13.07, 81.13.10, 83.13.06, 85.13.26, 87.14.06, 88.13.02, 91.13.10, 95.13.02, 05.13.01, 29.13.01]

1885

85.07.02 _____ Poisoned camels. *Garden & Field* **11** : 17. [July]

85.09.03 _____ New Australian plants. *South Australian Register, Adelaide* **50** : 5. [18 September]

85.14.03 Line 4: delete: 299.; replace with: 29.

1886

86.13.01 was published between 20 April and 10 May 1886. [ref. *Victorian Naturalist* **3** : 5–6 (May 1886) and **3** : 13 (June 1886). Stafleu & Cowan 1981 : 624, No. 6430, give 1885 (t.p.)]

86.14.01 Mueller, F. and R. Tate. [Description of *Dysphania simulans*] *In* R. Tate. Additions to the flora of extra-tropical South Australia, including descriptions of two new species. *Trans. & Proc. Roy. Soc. South Australia* **8** : 71.

86.14.02 _____ & F. M. Bailey. [Description of *Xanthostemon pachyspermus*] *In* F. M. Bailey, Occasional papers on the Queensland Flora. No. 1 : 4. [May]

1887

87.14.06 _____ & C. Naudin. Manuel de l'acclimateur ou choix de plantes recommandées pour l'agriculture, l'industrie et la médecine. Adaptées aux divers climats de l'Europe et des pays tropicaux. (Société d'Acclimatation : Paris) [see also 76.13.03, 80.13.07, 81.13.10, 83.13.06, 85.13.26, 88.13.02, 91.13.10, 95.13.02, 05.13.01, 29.13.01]

1888

88.01.03 _____ Flora of King Island. List of plants collected on King Island. *Victorian Naturalist* **4** : 140–146. [January]

88.05.04 _____ [Letter] *Pastoral Times, Deniliquin* (New South Wales) : 2. [19 May]

88.05.05 _____ [Note] *In* A. H. S. Lucas, Address by the President. *Victorian Naturalist* **5** : 6–8. [May]

88.13.03 was published between late November and 10 December 1888. [ref. *Victorian Naturalist* **5** : 135–136. (January 1889), and **5** : 137. (February 1889)]

1889

89.13.05 (or "Extra-print" 89.13.06 ?) published before 10 December 1888. [ref. *Victorian Naturalist* **5** : 136. (January 1889) and **5** : 137. (February 1889)

89.13.12 was published after 9 December 1889. ["Baron F. von Mueller forwarded for inspection an advance copy" to the meeting on that date. Ref. *Victorian Naturalist* **6** : 137. (January 1890)]

89.13.13 was published before 13 May 1889. [ref. *Victorian Naturalist* **6** : 42 (July 1889)]

1890

90.02.03 Mueller, F. [Note sub *Acacia notabilis*] *In* J. E. Brown, The forest flora of South Australia. (Government Printer : Adelaide). [February] [ref. Hj. Eichler, *S.Austral.Naturalist* **36** (3) : 39–42. (March 1962)]

90.14.05 _____ & J. E. Brown. *Eucalyptus Lansdowneana* (Von Mueller and J. E. Brown). *In* J. E. Brown, The forest flora of South Australia. (Government Printer : Adelaide). [February] [ref. Hj. Eichler, *S.Austral.Naturalist* **36** (3) : 39–42 (March 1962)]

1891

91.05.05 _____ The West Australian Natural History Society. *Western Mail, Perth* **6** : 16. [9 May] [see also 91.05.04]

91.13.10 was published before 14 September 1891. [ref. *Victorian Naturalist* **8** : 85. (October 1891)]

1893

93.06.04 Mueller, F. The late Alphonse de Candolle. *Victorian Naturalist* **10** : 22–25. [June]

93.13.02 was published before 13 March 1893. [ref. *Victorian Naturalist* **9** : 179. (April 1893)]

1894

94.14.03 delete: [3], replace with: [iii]

1895

95.11.02 Mueller, F. Timber and fruit diseases. *The Age, Melbourne* 1895 : 7. [16 November]

1896

96.10.05 _____ The search for Leichardt [sic]. *Adelaide Observer* : 42 [17 October]

96.10.06 _____ [2 letters] *In* The late Baron von Mueller. Some interesting notes. *Adelaide Observer* : 43. [24 October] [see also 96.11.01]

96.11.01 _____ [2 letters] *In* The late Baron von Mueller. *Garden & Field* **22** : 139. [November] [see also 96.10.06]

96.14.04 _____ & L. Rodway. [Description of *Gaimardia fairfaxii*] *In* L. Rodway. On a new Centrolepideae. *Pap. & Proc. Roy. Soc. Tasmania* 1894–95 : 55, pl. [August]

1929

29.13.01 _____ Diccionário de plantas úteis próprias para cultura, principalmente nas regiões extra-tropicais, com as indicações da pátria de cada uma e de muitas das applicações que delas se podem fazer. (Portuguese translation by Dr. Julio Henriques) Second edition, illustrated with numerous engravings. (Gazeta das Aldeias : Porto). [see also 76.13.03, 80.13.07, 81.13.10, 83.13.06, 84.13.22, 85.13.26, 87.14.06, 88.13.02, 91.13.10, 95.13.02, 05.13.01]

ABBREVIATIONS OF THE TITLES OF PERIODICALS

Arch. Pharm. (Hannover) Archiv der Pharmacie. Eine Zeitschrift des allgemeinen deutschen Apotheker-Vereins. Abtheilung Norddeutschland. Hannover.
S. Austral. Naturalist South Australian Naturalist, Adelaide.

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Barnard, F. G. A. (1899). The *Southern Science Record. Victorian Naturalist* 16 : 112–113.
Carr, D. J., & Carr, S. G. M. (eds) (1981). 'People and Plants in Australia' (Academy Press : Sydney).

Churchill, D. M., Muir, T. B. & Sinkora, D. M. (1978). The published works of Ferdinand J. H. Mueller (1825–1896). *Muelleria* 4 : 1–120.
Muir, T. B. (1979). An index to the new taxa, new combinations and new names published by Ferdinand J. H. Mueller. *Muelleria* 4 : 123–168.
Muir, T. B. (1981). Dates of publication of Australian pharmacy journals in connection with taxonomy. *Muelleria* 4 : 385–387.
Stafleu, F. A. & Cowan, R. S. (1981). 'Taxonomic Literature. A Selective Guide to Botanical Publications and Collections with Dates, Commentaries and Types.' edn 2, Vol. 3 : Lh — O. (Bohn, Scheltema & Holkema : Utrecht). *Regnum veg.* 105 : 615–625.

Manuscript received 15 February 1983.

FIVE NEW TAXA IN PTILOTUS R.Br. (AMARANTHACEAE) FROM THE NORTHERN TERRITORY

by

G. Benl*

ABSTRACT

Two new species and three new varieties of *Ptilotus* from the Northern Territory, Australia, are described and discussed. These are *P. comatus, P. rotundatus, P. lophotrichus* var. *villosus, P. aristatus* var. *exilis* and *P. exaltatus* var. *glaber*. The first three of these taxa are illustrated by analytical drawings and photographs of their type specimens. *P. eichlerianus* Benl is reduced in rank to *P. aristatus* var. *eichlerianus* (Benl) Benl & Hj. Eichler.

Three keys are provided, namely a key to *Ptilotus* taxa with more or less comose tepal apices (including the first three new taxa listed above), a key to the varieties of *P. aristatus* and a key to the varieties of *P. exaltatus*.

TAXONOMY

Ptilotus lophotrichus Benl var. **villosus** Benl, var. nov., praecipue ob flores minores, tepala exteriora latiora et indumentum dorsale perianthii manifeste amplius a varietate typica differt.

Distinguished from the type variety by different size, shape and pubescence of the outer floral organs. *Bracts* 2.5-3 x 1.4-1.8 mm; *bracteoles* 2-2.5 x 1-1.6 mm; *outer tepals* more limbate, 2.7-3.1 mm long x 1-1.3 mm wide; *inner tepals* 2.6-3 mm long x 0.7-1 mm wide; *apical hairs on tepals* attaining 1.5 mm and overtopping the segments by 1.1 mm; *outer basal hairs* almost straight, to 0.6 mm long, continued up to the middle of the tepals or sometimes even higher on the inner ones, hence consistently obscuring part of the median red area of the tepals. Figs 1, 2a, 4a.

Comparable characters for the var. *lophotrichus* are — *bracts* 4.7-5.5 x 1.8-2.2 mm; *bracteoles* 3.3-4 x 1.2-1.7 mm; *outer tepals* 3.8-4.1 x 0.9-1.2 mm; *inner tepals* 3.2-3.7 x 0.7-1 mm; *apical hairs on tepals* attaining 2 mm, overtopping the segments by 1.2 mm; *outer basal hairs* minute and not masking the median area of the tepals (see *Trans. Roy. Soc. S. Aust.* 88:57, fig. 2c (1964)).

Type Collection: Near the Goyder River Crossing on the road to Gove, near 12° 51′ S., 135° 02′ E., Arnhem Land, Northern Territory, *Symon 7723*, 17.vi.1972. In open grassy *Eucalyptus* woodland. (Holotype: M. Isotype: ADW 40952).

Notes:

Symon 7723 was initially regarded as a second collection of *Ptilotus lophotrichus* (see *Mitt. Bot. Staatssamml. München* 15: 167 (1979)), but on closer comparison with the holotype of *P. lophotrichus* the constant floral differences given above became evident. As the terminal pubescence of the tepals matches that of typical *P. lophotrichus*, infraspecific rather than specific recognition is justified.

Ptilotus comatus Benl sp. nov., affinis *P. lophotricho*, a quo praesertim pubescentia diversiformi perianthii et bractearum, forma tepalorum et bracteolarum recedit.

Planta annua tenera usque ad 0.6 m alta ramosa parce foliata plurispicata basi lignosa. *Caules* ramulique (curvati-) erecti et folia juvenilia pilis crispis albidis crassiusculis tomentosula. *Folia* angustissime linearia 0.5-2.5 cm longa. *Inflorescentiae* primo ovoideae dein cylindraceae ad c. 4 x 0.8 cm, solitariae vel 2-3 compositae, omnes ramulos terminantes. *Flores* c. 40-80 (100) conferti visu (pallide) rosei demum stramineo-flavescentes. *Bracteae* bracteolaeque acutae inaequales: bracteae elongatae vel elongati-ovatae, longitudinem perianthii vix attingentes, in dimidio superiore sparse

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Muelleria 5(4): 249-261 (1984).

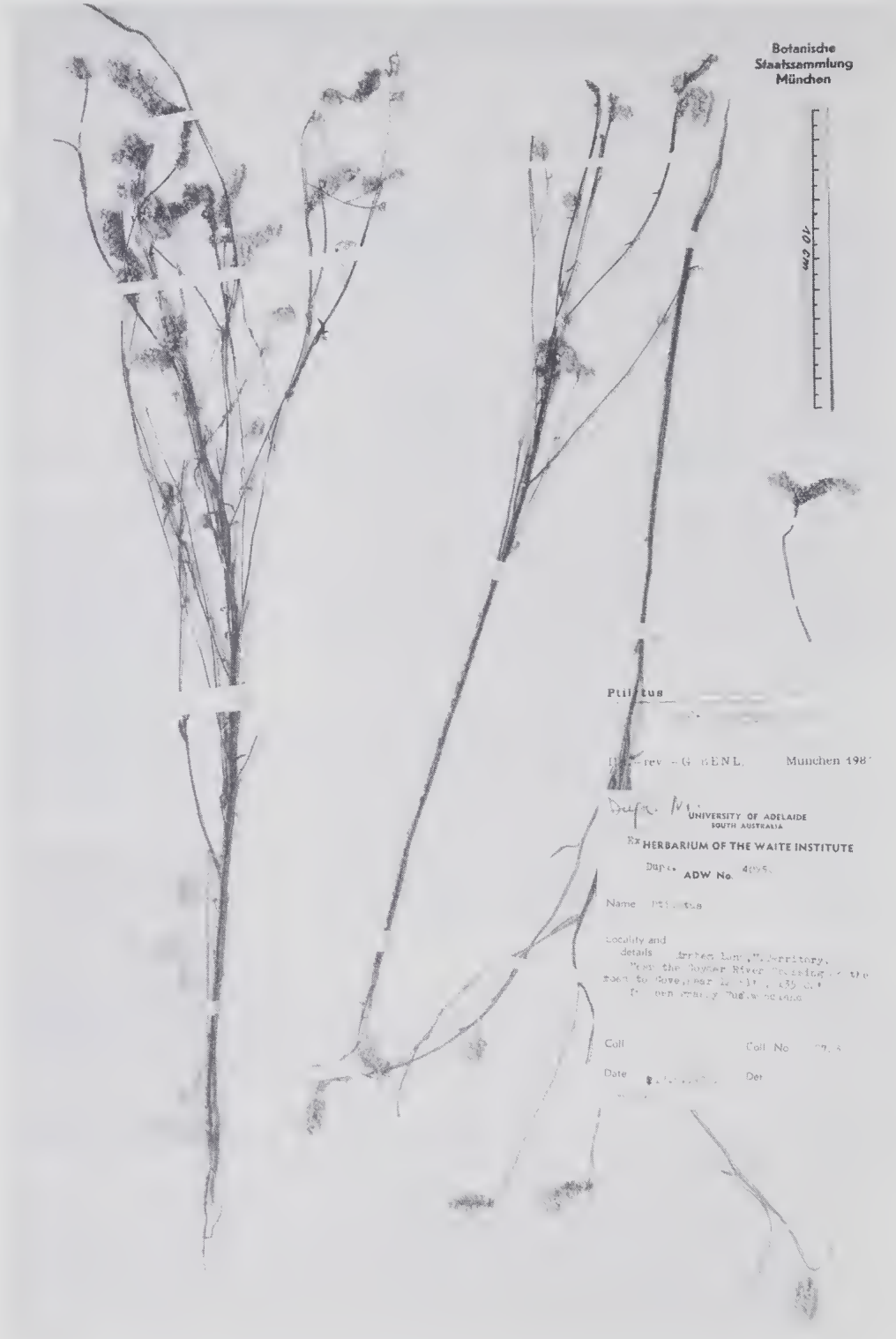

Fig 1. *Ptilotus lophotrichus* var. *villosus*. Holotype *(Symon 7723*, M).

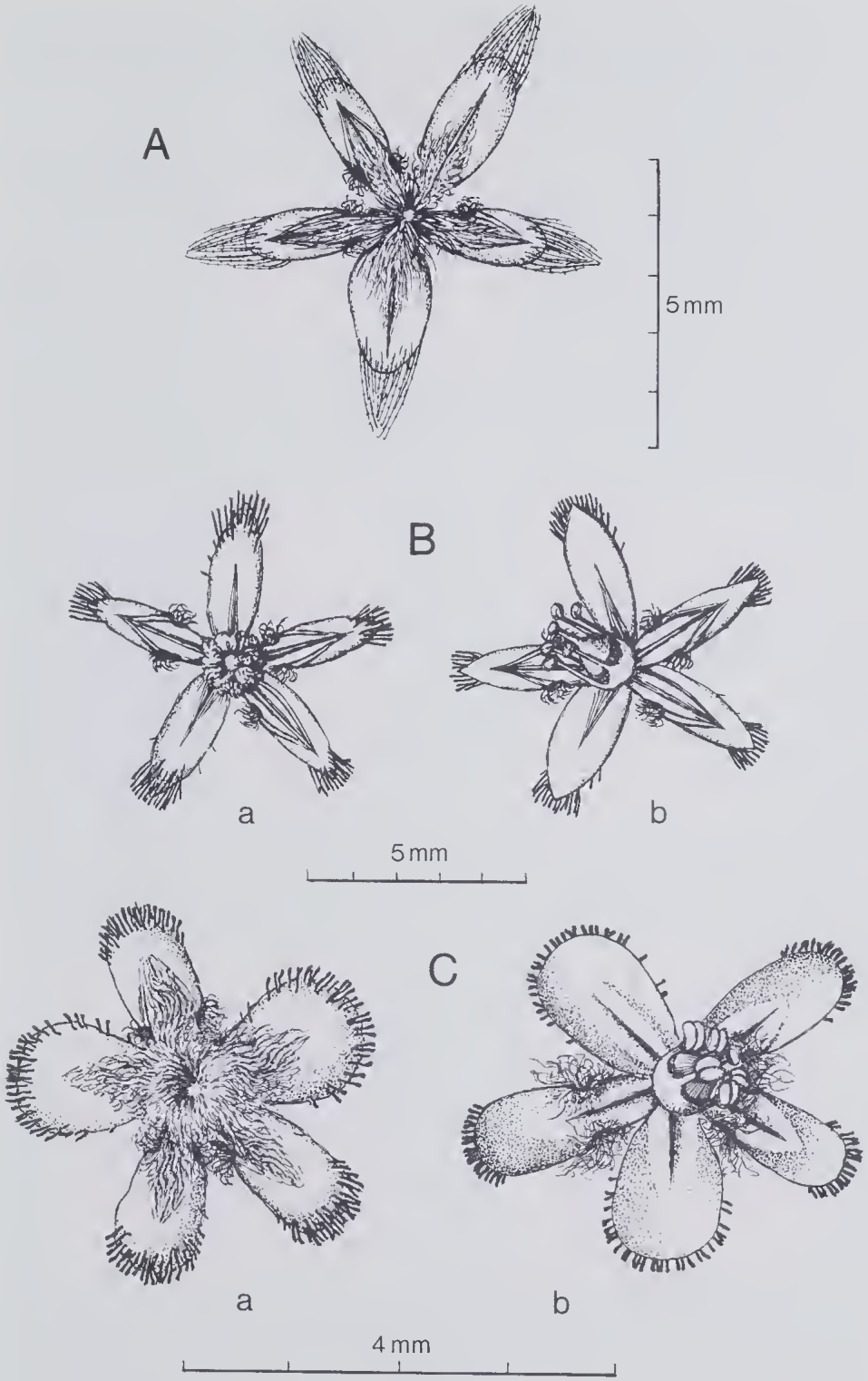

Fig. 2. Spread perianths of *Ptilotus* spp. A — *P. lophotrichus* var. *villosus*, outer view. B — *P. comatus*, outer view (a) and inner view (b). C — *P. rotundatus*, outer view (a) and inner view (b). All from the holotypes.

pilosae; bracteolae distincte minores (sub)ovatae ventricosae glabrae. *Perianthium* bicoloratum ima basi pilosula tantum contractum. *Tepala* libera acutiuscula, pilis niveis rectis crassiusculis conspicue (sub)fastigiatis breviter comata (Fig. 2B); 2 exteriora ad 3.8 x 1.2 mm, leviter carinata intus glabra; 3 interiora subaequilonga angustiora, extus distincte tricostata intus basim versus pilosiuscula, areola mediana purpurea. *Stamina* aequalia omnia fertilia, basi dilatata cupulam integram formantia. *Ovarium* complanati-globosum glaberrimum.

Ephemeral *herb* up to 60 cm tall. *Tap-root* slender, up to 3 mm diam. *Stem* upright, terete, finely striate, basally woody, producing near the base several arcuately ascending main branches (8 in the holotype), then continuing to c. 40 cm long and 1-1.5 mm in diameter near the middle, laxly branching again. *Stem and branches* all greyish green becoming reddish-tinged especially near the base, persistently hairy with crisp, rough, indistinctly articulate, whitish hairs to 1.2 mm long; all terminating in spikes. *Leaves* alternate, sessile or near-sessile, 3-33 mm apart, narrow-linear to narrow-elliptic with a slightly pointed tip and a somewhat tapering base, 5-15 (-25) mm long x 0.6-1.5 mm wide, pale green, hairy (as for stems) only when young, thickly coriaceous, becoming rugose when withering; margins ± revolute, often obscuring the midrib. *Spikes* up to 30 per plant, usually solitary or 2-3 congested at a branch apex, rarely axillary; small spikes ovoid(-conical); large spikes cylindrical, 10-40 mm long x 5-8 mm wide, bearing up to > 80 tightly arranged flowers. *Rachis* lanate with articulate intricate hairs c. 1 mm long, eoncealing the minute pedicels. *Pedicels* woody, jointed above the bracteoles. *Bracts and bracteoles* membranous-scarious, entire, (convex-)acute, appressed to the perianth, persistent. *Bracts* narrowly oblong to oblong-ovate, (2.4-) 3 (-3.3) x 0.8-1.2 mm, slightly shorter than the mature perianth, faintly keeled, sparsely clothed over the distal dorsal halves with obscurely articulate hairs up to 1.7 mm long; hairs not projecting beyond the bract tip. *Bracteoles* inconspicuous, (broad-)ovate, (1.3-) 1.6-2 (-2.2) x 0.8-1.1 mm, glabrous or almost so, nerveless, transparently shining. *Perianth* straight, thickened and hard towards an open disc-like base; base somewhat notched due to the sunken attachment of the pedicel, externally finely pubescent with a mat of closely-curled accumbent hairs c. 0.2 mm long; lower perianths deciduous as spikes elongate. *Tepals* free to the perianth base, entire, subequal in length, slightly concave-acute in about the distal halves; dorsal surface pilose towards the apex with broad short tufts of snowy white hairs which project beyond the tepal tip by c. 0.25 mm, almost all hairs ending at the same level (especially in young flowers), thus giving the tepal a brush-like aspect and the whole spike a sharp outline; hairs of the tufts up to c. 30, c. 0.5-0.9 mm long, septate and many with a more or less club-like end cell, stouter than those on the bracts, more or less easily breaking off. *Outer tepals* (oblong-)elliptic, 3.2-3.6 (-3.8) x 1-1.2 mm in the holotype, with a narrow deltoid opaque area along a central externally prominent reddish line in lower halves, the larger transparent marginal zones shiny on both surfaces; tepals glabrous except for the comose apex, a few shorter marginal hairs and the basal mat of curly hairs. *Inner tepals* narrower, sublinear, (3-) 3.3-3.5 (-3.7) x 0.6-0.7 (-1) mm in the holotype, more rigid, with three bold ribs on the dorsal surface, the lateral ribs bordering a coriaceous, usually glabrous, distally tapered, ± purplish centre; scarious marginal zones vanishing basally, enlarging upwards and fusing into a 0.7-1 mm long apical comose portion; margins with irregular constrictions or incisions above the ovary and with sparse, delicate, more or less inflexed hairs c. 0.5 mm long inserted at and below the constrictions; outermost of the three inner tepals often constricted and hairy on one margin only and then ± similar to an outer segment in outline. *Androecium and gynoecium* much shorter than the perianth. *Stamens* five, perfect, basally united into a turbinate glabrous hyaline cup-shaped tube 0.5-0.6 mm high; tube attached to the perianth disc for about the basal 0.15 mm; free parts of filaments flattened, up to c. 1.2 mm long, subulate towards the apex, c. 0.1 mm wide near the middle and dilated downwards to 0.35 mm; anthers broad-ellipsoid, averaging 0.3 x 0.2 mm at anthesis; pseudostaminodes absent. *Gynoecium* glabrous, sessile; ovary obovoid (1.2 x 0.9 mm) to complanate-globose (0.8-1 mm largest diam.); style central, straight, slender, 0.5-0.8 mm long, c. 0.08 mm across near the middle and slightly thickened downwards; stigma papillose, level with the anthers. *Seed* thick, lenticular, reddish brown. Figs 2b, 3, 4b.

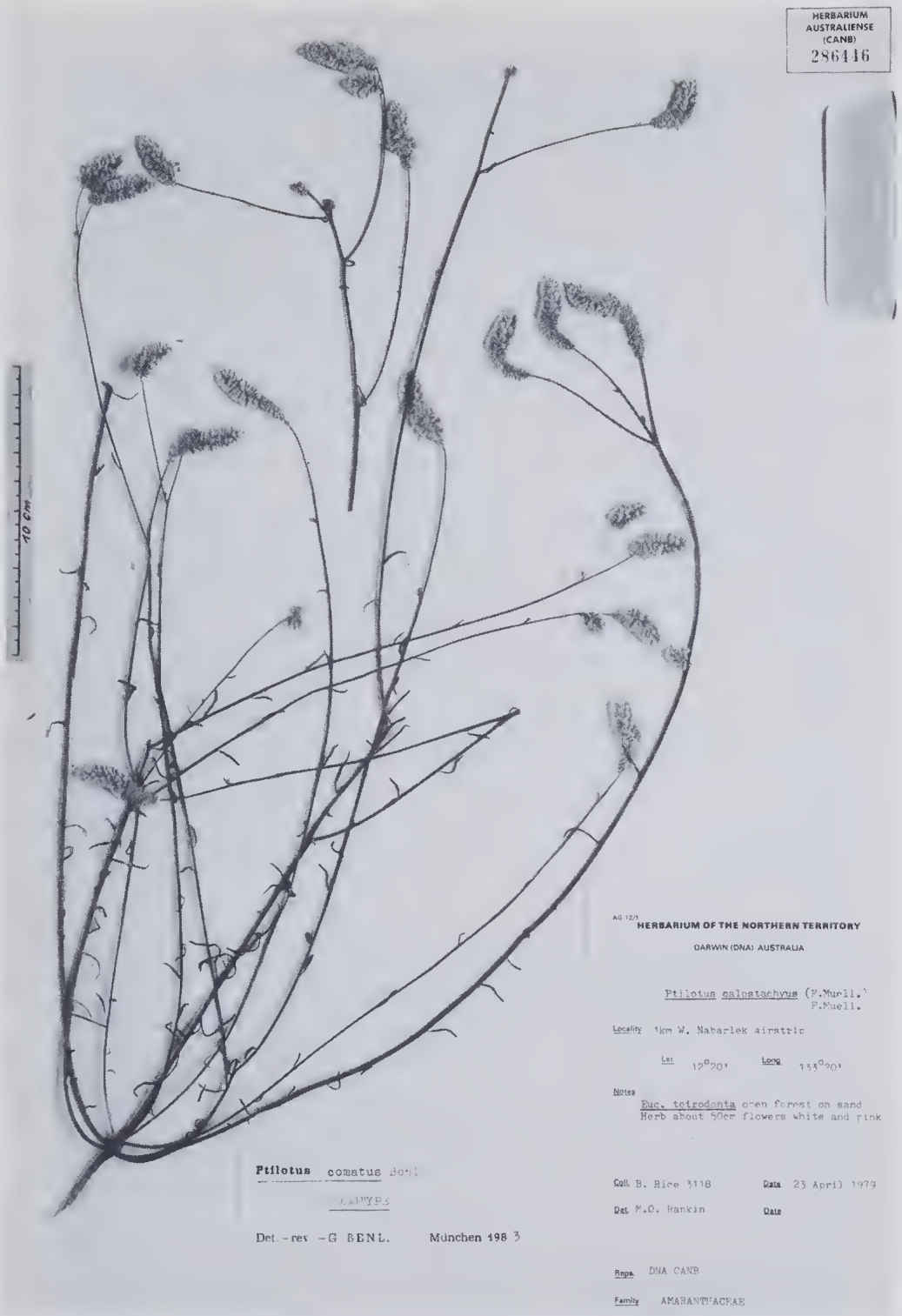

Fig. 3. *Ptilotus comatus*. Holotype *(Rice 3118*, CANB).

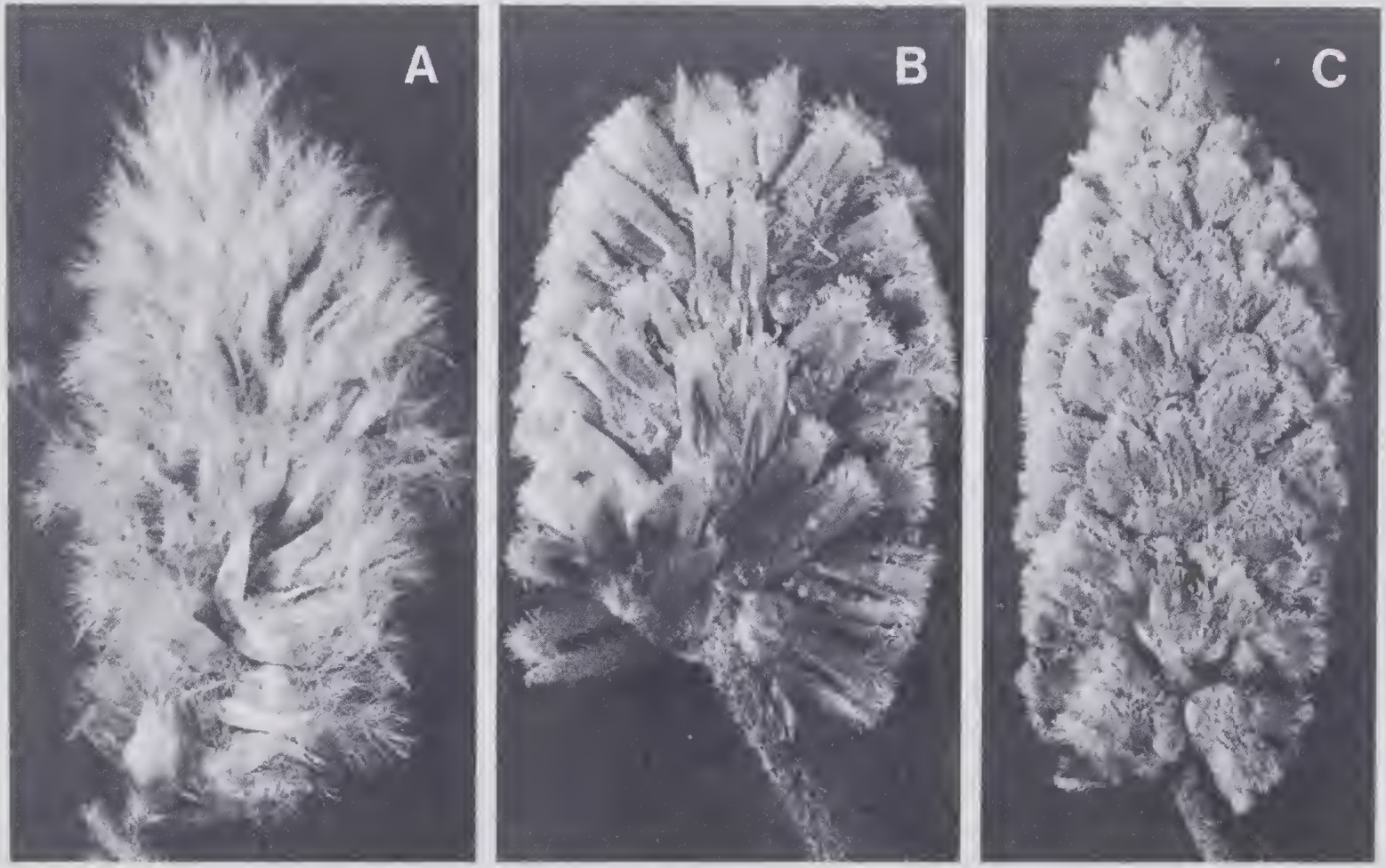

Fig 4. Spikes of *Ptilotus* spp., x 9. A — *P. lophotrichus* var. *villosus*. B — *P. comatus*. C — *P. rotundatus*. All from the holotypes.

TYPE COLLECTION: 1 km N. of Nabarlek airstrip, 12° 20′ S., 133° 20′ E., Northern Territory, *B. Rice 3118*, 23.iv.1979 (Holotype: CANB 286446. Isotype: DNA).

ALSO EXAMINED:

Northern Territory — Myra Falls vicinity, Tin Camp Creek, 12° 28′ S., 133° 20′ E., 29.v.1973, *T. Hartley 13799* (CANB 244844, NT 45931). Nabarlek area, near water supply dam, 12° 20′ S., 133° 19′ E., 20.iv.1979, *M. O. Rankin 2047* (AD, DNA).

DISTRIBUTION:

Probably endemic in the Northern Territory, occurring in a restricted area east of Oenpelli, Arnhem Land.

ECOLOGY:

Collection labels state "*Eucalyptus tetrodonta* forest on sand", "sandy depression in broken sandstone" and "dry open sandy area".

NOTES:

There is a superficial similarity to *Ptilotus calostachyus* (F.Muell.) F.Muell. var. *calostachyus* but the latter has long-ciliate pseudostaminodes. *P. comatus* resembles *P. lophotrichus* in the structure of the inner floral parts but it is distinguished from that species by the different shape and pubescence of the outer floral organs. In *P. lophotrichus* the bracteoles are carinate and differ very little in length and pubescence from the bracts, which more or less reach or surpass the perianth. The generally more obtuse tepals of *P. lophotrichus* are much exceeded by their apical tufts of longer, thinner, flaccid, distinctly articulate hairs, thus rendering the spikes soft and obscuring their outline in contrast to those of *P. comatus*. The brush-like apical pubescence consisting of septate hairs with somewhat claviform end cells clearly demarcates *P. comatus* from all other known comparable taxa.

Hartley 13799 and *Rankin 2047* differ from the holotype in having narrower spikes, differently shaped bracts and bracteoles, and the apical hairs of the perianth usually shorter and stouter and often with a more thickened end cell. However, they show gradations towards the holotype.

Ptilotus rotundatus Benl, sp. nov., imprimis floribus juvenilibus subglobosis, tepalis exterioribus valde rotundatis et pilis brevibus apicem tepalorum marginantibus a speciebus adhuc cognitis distinguitur.

Planta annua tenera usque ad 0.5 m alta ramosa basi lignosa modice foliata plurispicata. *Caules* ramulique erecti et folia juvenilia pilis crispis albidis tomentosuli. *Folia* anguste linearia ad 4 cm longa. *Inflorescentiae* solitariae vel 2-4 compositae ramulos terminantes, multi- et confertiflorae, primo conici-ovoideae ad 1 cm longae, demum ad c. 2 cm elongatae, 0.5 cm in diametro. *Bracteae* bracteolaeque inconspicuae sparse pilosae inaequales: bracteae acutae ovatae, bracteolae late ovatae. *Perianthium* convexum pubescentia albidum, ima basi in tubum brevem constrictum. *Tepala* in apice rotundato pilis conspicue brevibus crassis marginata, tricostata, costae intus pulvinas includentes (Fig. 2 C b) extus indumento villoso obtectae; 2 exteriora suborbicularia ad 1.8 x 1.3 mm visu ciliata intus glabra; 3 interiora paulo longiora angustiora plus minusve bipartita, intus inferne pilis marginalibus copiosis tenuibus intricatis obsessa. *Stamina* aequalia omnia fertilia basi dilatata in cupulam hyalinam integram coalita. *Ovarium* subglobulare glaberrimum; stylo brevi.

Annual *herb* c. 35-50 cm tall, pubescent with whitish, rough, closely-curved, almost appressed hairs c. 0.5 mm long over the stems, branches and foliage, the latter subglabrous with age. *Tap-root* slender, fusiform, up to 3 mm diam. *Stem* up to 3.5 mm thick, laxly producing erect wiry branches from near the base upwards; branch apices becoming the peduncles and rachises of narrow inflorescences. Stem and branches terete and reddish basally, striate and light to yellowish green in upper portions, often purplish towards young spikes, leafy throughout. *Leaves* cauline, alternate with internodes of 1-2 cm, spreading, greyish green, linear-lanceolate, tapering on both ends, c. 5 to 40 mm long x to 1.2 mm wide, cuspidate with a purplish point when juvenile; margins almost parallel and entire; midrib prominent on lower surface; upper leaves sometimes becoming bract-like and purplish tinged. *Spikes* to c. 40 per plant, terminal, solitary or 2-4 together

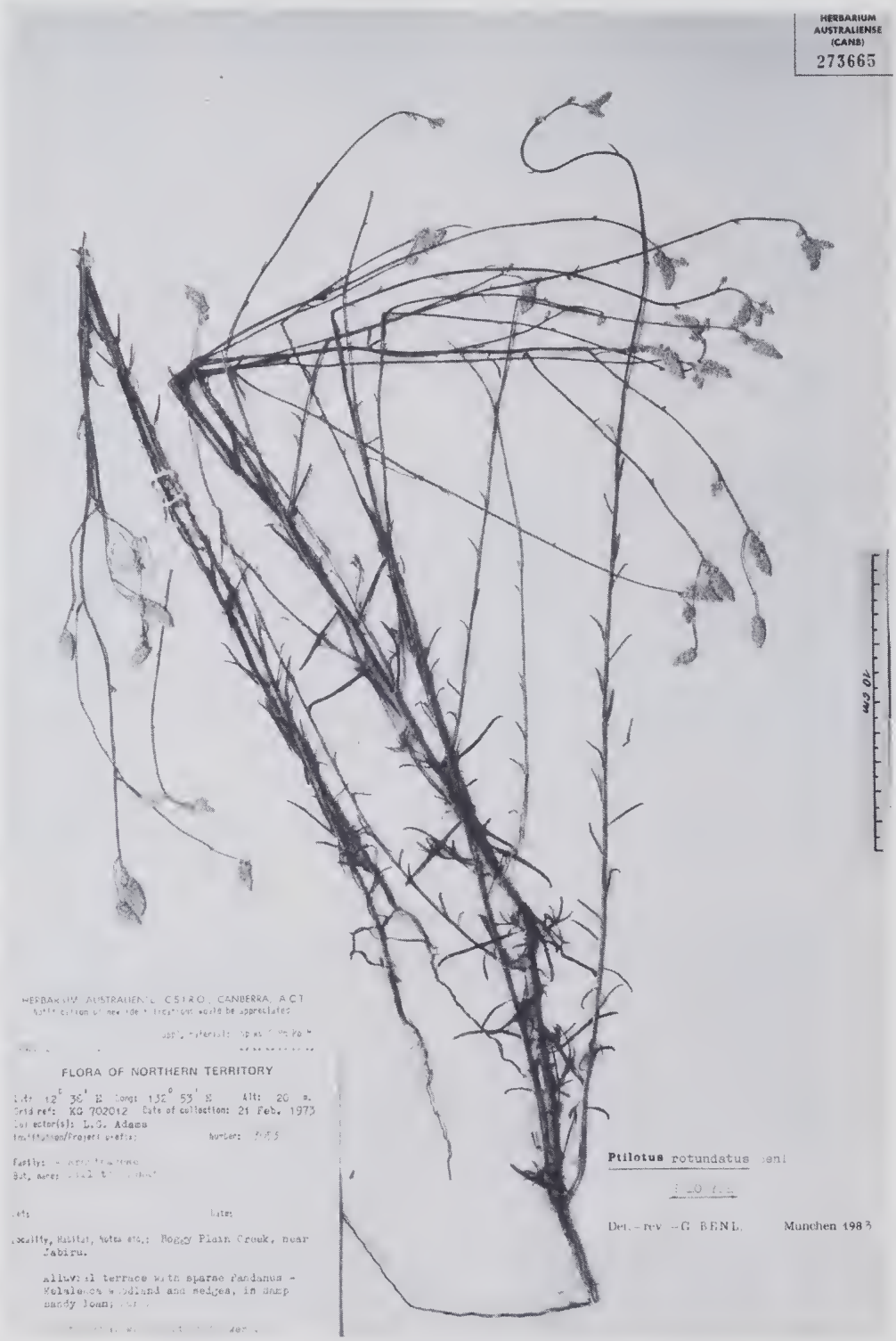

Fig. 5. *Ptilotus rotundatus*. Holotype *(Adams 3053*, CANB).

at or near a branch apex, rarely sessile in leaf axils, ovoid- to oblong-conical, to c. 2 cm long and consistently 0.5 cm wide, bearing up to 30 (-40) short-pedicellate flowers; flowers densely crowded (lowest ones sometimes distant), subglobose when young, campanulate at anthesis. *Rachis* rigid, averaging 0.4 mm diam., tinged dark purplish when young, villous; hairs crisp to almost straight, articulate, thinner than those on stems, c. 1 mm long and enveloping lower parts of the flowers. *Pedicels* hairy, c. 0.2 mm long, dilated to 0.3 mm diam. at the joint above the bracteoles. *Bracts and bracteoles* membranaceous, straw-coloured, entire, concavely appressed to the perianth, persistent, sparsely clothed initially with some short straight thickish hairs over the distal halves but soon turning glabrous; midrib not evident. *Bracts* oblong-ovate, acute, (1.1-) 1.3-1.5 (-1.6) x 0.8-1 (-1.1) mm, with a dark purple spot when young, initially longer than but finally ± equal to the perianth. *Bracteoles* (sub)cordate-ovate, 0.8-1 (-1.1) x 0.8-0.9 (-1) mm. *Perianth* thickened and constricted to a callose short-tubular base; base c. 0.3 mm long in juvenile flowers, then flattening, finally concave below due to sunken attachment of the pedicel, densely villous-pubescent outside with waved faintly articulate hairs 0.7-0.9 mm long, the hairs also extending over the opaque median area of the tepals and obscuring the lower half or more of the outer perianth surface. *Tepals* entire, convex in upper regions; outer surface villous-pubescent below (see perianth) and glabrous between that pubescence and a distinctive apical vestiture of c. 15-30 thick hairs; apical hairs hyaline, short-septate with an obvious claviform terminal cell, 0.1-0.3 (-0.5) mm long, ± tuft-like on inner tepals and there mostly exceeding the tip by up to 0.25 mm, usually less dense, shorter, more fringe-like and extended further downwards along about half of the margin on outer tepals. *Outer tepals* broad-obovate or almost circular, (1.4-) 1.6-1.8 x (0.9-) 1.1-1.2 (-1.3) mm, the midrib of each keeled on the lower half, the keel obscured by the vestiture; inner surfaces glabrous, the midveins obvious and depressed, the two lateral veins fainter and with a small cushion between each of them and the midvein; outer transparent portions shiny on both surfaces. *Inner tepals* slightly longer, narrower, (1.5-) 1.8-2 mm long and 0.7-0.8 (-0.9) mm wide above the middle, more or less clearly divided into a linear claw-like and an expanded scarious limb-like part; inner surface pilose or woolly inside with beards of delicate loosely intricate hairs up to 0.7 mm long originating from and below the constriction and usually incurved along either side of the "claw"; division between "claw" and "limb" indistinct when beard is on one side only; "claw" 0.4 to 1.2 mm long, made rigid by the lower portions of the three externally prominent but hidden ribs; lateral veins convergent towards the apex without reaching it, ventrally enclosing two cushions (as with the outer tepals). *Stamens* five, perfect, basally united to a glabrous membranous turbinate cupula 0.6-0.7 mm high; cupula adnate at the base to the perianth disc; free parts of filaments flattened, 0.4-0.6 mm long, tapering upwards, about 0.1 mm wide near middle, broadened to 0.25 mm at base; anthers roundish in outline, c. 0.35 x 0.3 mm, reddish when very young; pseudostaminodes absent. *Gynoecium* glabrous, short-stipitate in young flowers, at length subsessile; ovary obconical, 0.7 x 0.6 mm, becoming sub-globose (1.1 x 0.9-1 mm) with maturity; style central, straight, c. 0.25 mm long, 0.04-0.06 mm in diam. near middle, slightly thickened at base; stigma capitellate, to 0.1 mm wide, papillate, level with the anthers. *Seed* globose, reddish brown. Figs 2c, 4c, 5.

TYPE COLLECTION: Boggy Plain Creek, near Jabiru, 12° 38′ S., 132° 53′ E., 20 m alt., Grid KG 701012, Northern Territory, *L. G. Adams 3053*, 21.ii.1973 (Holotype: CANB 273665).

ECOLOGY:

"Alluvial terrace with sparse *Pandanus-Melaleuca* woodland and sedges, in damp sandy loam; rare" (Adams).

NOTES:

This species, represented only by the type collection, is noteworthy for its rotund outer tepals (hence the specific epithet) and their unique apical pubescence giving the flowers a quite unusual aspect. In general appearance as well as inner floral organs *P.*

rotundatus shows affinities with other species bearing more or less tufted perianth hairs, viz. *P. lanatus* Cunn. ex Moq., *P. lophotrichus* (var. *lophotrichus* and var. *villosus*) and *P. comatus*, but it is readily differentiated as shown by the following key.

Key to Ptilotus Taxa with more or less Comose Tepal Apices

To replace, on page 151, part of the key to *Ptilotus* species by Benl in *Mitt. Bot. Staatssamml. München* 9 : 135–176 (1971)

37. Dorsal surface of perianth with a tuft or fringe of apical hairs isolated from the proximal zone of hairs; inner tepals ± pubescent towards the base on the ventral surface
  a Tepals, bracts and bracteoles terminated by an elongated tuft of thin flexible hairs >1 mm long ..... *P. lophotrichus*
    b Base of perianth covered on the dorsal surface with a mat of minute, slightly curved hairs ..... var. *lophotrichus*
    b+ Base of perianth villous with longer crisp to straight hairs to 0.6 mm long continued up to about the middle of the tepals ..... var. *villosus*
  a+ Tepals and bracts terminated by shorter thicker rigid hairs
    c Spikes to 4 x 0.8 cm, white and purplish; perianth up to 3.8 mm long, pubescent at the base on the dorsal surface; tepal apices attenuate, terminated by tufts of hairs c. 0.5-0.9 mm long; inner tepals slightly pilose inside, the veins clearly visible ..... *P. comatus*
    c+ Spikes to 2 x 0.5 cm, whitish; perianth c. 2 mm long, the dorsal surface pubescent over the base and the lower halves of the tepals; tepal apices broadly rounded, wreathed by very short hairs to 0.3 (-0.5) mm long; inner tepals ± densely pilose inside, the veins partly obscured ..... *P. rotundatus*
37+. Dorsal surface of perianth with hairs throughout; inner tepals glabrous on the ventral surface ..... *P. lanatus*

Ptilotus aristatus Benl var. **exilis** Benl, var. nov., a varietate typica imprimis spicis conspicue angustioribus, bracteis bracteolisque vix coloratis, bracteolis breviter acuminatis differt.

Differs from the type variety (see Benl, *Mitt. Bot. Staatssamml. München* 4 : 79–82, fig. 2 (1961)) chiefly in having much narrower spikes and almost colourless bracts and brateoles with the bracteoles being short-acuminate.

Spikes 10 to 15 or more per plant, hemispherical and 1.4-1.8 cm diam. or ovoid or (sub)cylindric and then to 3.6 x 1.6 cm, sometimes very small with as few as 5 flowers; *bracts* pale, to 5.2 mm long x 1.8 mm wide, villous with hairs 1.7-2 mm long, the awn-like point c. 1 mm long; *bracteoles* colourless or nearly so, c. 4.6 mm long x 2.6 mm broad, the mucro 0.7 mm long at most; *outer tepals* 8.5-10 mm long x 0.8-1 mm wide, with a glabrous truncate apical part to 1.7 mm long; dorsal hairs to 2 mm long; *inner tepals* 7.5-9 mm long x 0.6 mm broad, the incurved apex c. 1.2 mm long; *free part of fertile filaments* c. 3 mm long; *anthers* averaging 0.6 x 0.3 mm; *style* c. 1.8 mm long.

Comparable characters for the var. *aristatus* are — *spikes* 8-12 per plant, (ob)ovoid to subcylindric, up to 4 x 2.5 cm, each with up to 40 or more densely-crowded flowers; *bracts* brown(ish), up to 7 x 2 mm, with hairs up to 2.5 mm and an awn of 2-3 mm; *bracteoles* slightly brownish towards the midrib, c. 6.5 x 3.5 mm, the awn 2-3 mm; *outer tepals* 13-14 x 1.2 mm, the apical part up to 2.5 mm, the dorsal hairs to 4 mm; *inner tepals* 11.5-12.5 x 1 mm, the ± incurved tips to 2 mm; *free part of fertile filaments* up to c. 6 mm; *anthers* averaging c. 0.8 x 0.45 mm; *style* up to 3.8 mm.

Type Collection: 54 miles (86.4 km) NW. of Alice Springs, Northern Territory, *Chippendale 8799*, 3.v.1962 (Holotype: M. Isotypes: AD, CANB, NSW, NT). Plate 8 (col.) in *Aust. Pl.* 4: 124 (1967), *sub Ptilotus aristatus*.

Also Examined:

Northern Territory — Amburla Creek, WNW. of Alice Springs, 23.ii.1978, *Benl (Au 48), Maconochie & Lois Ulyatt* (CANB, M, NT). Milton Park, WNW. of Alice Springs, 12.xii.1973, *C. Lendon s.n.* (NT).

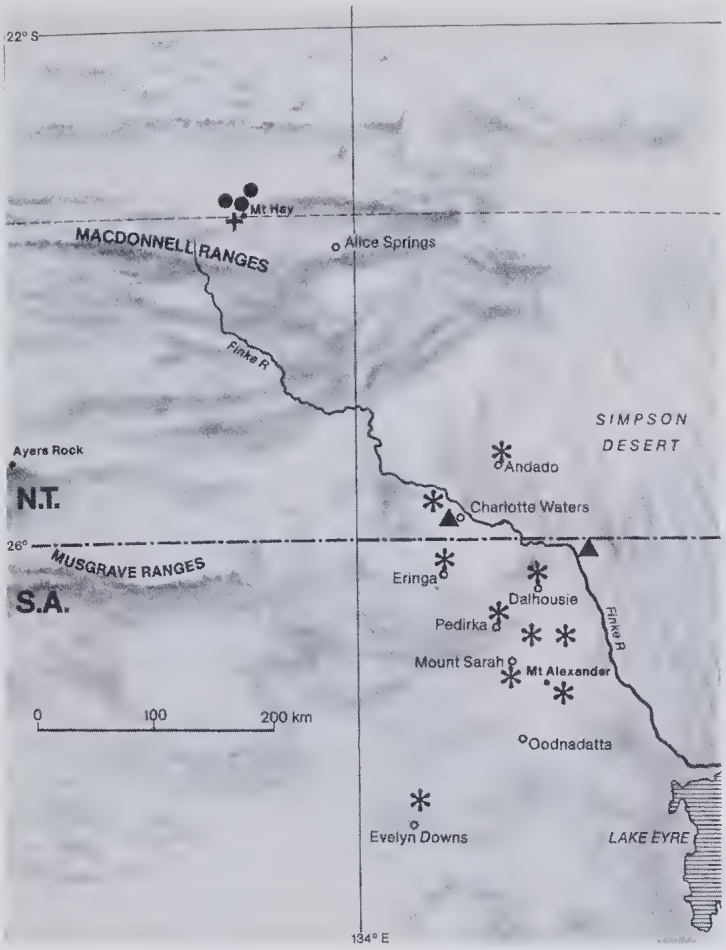

Fig. 6. The distribution of the varieties of *Ptilotus aristatus*.
▲ — var. aristatus
* — var. eichlerianus
● — var. exilis
\+ — var. stenophyllus

Distribution (Fig. 6):
Apparently restricted to a comparatively small area WNW. of Alice Springs.

Ecology:
Recorded on specimen labels as "infrequent on *Astrebla pectinata* plain" and "on heavy clay soil plains with Mitchell grass". We found it on red cracking clay soil with perennial tussock grassland. Fl. Dec.—May.

Ptilotus aristatus var. **eichlerianus** (Benl) Benl & Hj. Eichler, stat. nov.
Basionym: *Ptilotus eichlerianus* Benl, *Mitt. Bot. Staatssamml. München* 7 : 310–314, fig. p. 312 (1970).

Ptilotus aristatus var. *eichlerianus* differs from the type variety chiefly in having broader spikes, deeper coloured bracts (these usually smaller than the bracteoles) and a denser, longer indumentum of young shoots and often also of the perianth.

With the recognition of three varieties of *P. aristatus*, i.e. var. *aristatus*, var. *exilis* (described above) and var. *stenophyllus* Benl *(J. Adelaide Bot. Gard.* 1 : 204 (1979)) since *P. eichlerianus* was described, it has become clear that the latter belongs to a

complex within *P. aristatus*. It resembles *P. aristatus* var. *aristatus* more closely than do the other two varieties and is therefore reduced to varietal rank.

DISTRIBUTION (Fig. 6):

Southern Northern Territory and northern South Australia from about Andado Station, N.T. south to Evelyn Downs, S. Aust. Thirteen collections examined.

NOTES:

Intermediate forms between var. *aristatus* and var. *eichlerianus* exist, e.g. 16 km E. of Hamilton homestead, South Australia, 26° 39′ S., 135° 11′ E., 31.x.1974, *P. L. Milthorpe 3063* (NSW 139395) — location details provided by Milthorpe in litt., viii.1983.

KEY TO THE VARIETIES OF PTILOTUS ARISTATUS

1. Basal leaves narrow-lanceolate, to 8 cm long x 0.5 cm wide (spike c. 1.7 cm diam.; bracteole point 0.7 mm long) ..... var. *stenophyllus*
1. Basal leaves obovate to spathulate or broad-lanceolate, to 18 cm long x 2.8 cm wide
   2. Spikes to 1.8 cm diam.; bracteoles short-pointed, the point to 0.7 mm long..... var. *exilis*
   2. Spikes broader, to 2.5 or 3.5 cm diam.; bracteoles long-pointed, the awn attaining 3 mm
      3. Spikes mostly (sub)hemispherical heads up to 3.5 cm diam.; perianth to 17.5 mm long; bract and bracteoles unequal in length ..... var. *eichlerianus*
      3. Spikes (ob)ovoid to subcylindric, up to 2.5 cm diam.; perianth to 14 mm long; bract and bracteoles subequal in length..... var. *aristatus*

The four varieties of *P. aristatus* all possess the following characters — *stem base* pilose; *leaves* marginate apiculate or mucronate; *bracts and bracteoles* with a ± awn-like point; *tepals* narrow, violet or reddish fading apically to white, with two kinds of dorsal hairs and a short keel above the long perianth tube, also with glabrous finely serrulate apices; *fertile stamens* 2 (rarely 3), the *stamens and staminodes* markedly widened towards the base to form an entire cup; *ovary* long-stalked, clavate, usually biserial pilose near the summit; *style* eccentric.

Ptilotus exaltatus Nees var. **glaber** Benl, var. nov., differt a varietate typica ob omnes partes florum glabras vel glabratas.

This taxon is distinctly separate from the other varieties of *Ptilotus exaltatus* by the total or almost total lack of pubescence on the bracts and the perianth as well as on the gynoecium. Traces of hairs may sometimes be found with the aid of a lens.

TYPE COLLECTION: 4.8 miles (7.7 km) E. of Ormiston Gorge turnoff on Glen Helen road, 23° 42′ S., 132° 42′ E., Northern Territory, *N. M. Henry 438*, 19.vi.1972. Erect annual with bright crimson glabrous flowers. Very rare in gravelly soil on edge of roadside. (Holotype: NT 35691. Isotypes: NY, MO).

ALSO EXAMINED:

Northern Territory — 72 miles (115 km) W. of Alice Springs on Glen Helen Road, *B. M. Alright 138*, 17.vi.1972. Flowers dark mauve, not hairy and stiff. 10 cm long x 45 mm diam. Only one bush seen, in rocky soil beside road. (NT 36091).

KEY TO THE VARIETIES OF PTILOTUS EXALTATUS

1. Flowers hairless ..... var. *glaber*
   (Benl. *Muelleria* 5:260 (1984); Northern Territory west of Alice Springs — see localities above.)
1. Flowers more or less hairy
   2. Foliage persistently tomentose on both sides ..... var *villosus*
      (Benl, *Mitt. Bot. Staatssamml. München* 7 : 314 (1970);
      Western Australia, at Lake Moore and nearby Mollerin.)
   2. Foliage glabrescent
      3. Spikes conical lengthening to cylindric, attaining 30 x 5 cm ..... var. *exaltatus*
         (All mainland States, locally abundant.)
      3. Spikes capitate, 3-4 cm diam.
         4. Bracts and bracteoles brown(ish); all leaves narrow-linear (forms intermediate with the type variety exist) ..... var. *semilanatus*
            ((Lindl.) Maiden & Betche, 'Census N.S.W. Pl.' 72 (1916); all mainland States except Western Australia, but primarily from Queensland and New South Wales.)
         4. Bracts and bracteoles uncoloured; basal leaves subspathulate ..... var. *pallidus*
            (Benl. *Mitt. Bot. Staatssamml.* München 15 : 164 (1979);
            Northern Territory at Mt Olga, one collection only.)

ACKNOWLEDGEMENTS

The material for the above studies was made available to me during my visits to the herbaria of AD (+ ADW), CANB, DNA and NT; it was afterwards sent to München for a more thorough examination. I wish to express my appreciation to the Directors and Curators of these herbaria for working facilities in their institutions and for loans of the selected specimens. Sincerest thanks are due to Mrs and Mr John R. Maconochie for amicable hospitality in Alice Springs and for arranging field trips, also to Dr Barbara Rice (Sydney) and John Maconochie for valuable assistance with locality details. My deep gratitude is extended especially to Dr Hj. Eichler, Canberra, who has helped me in many ways and read the text of this paper concerning *P. aristatus*, to Mr A. Böhm, München, who prepared figures 2 and 6 and to Mr K. Liedl, München, who produced the photographs. I finally wish to express my sincerest appreciation to the editor, Miss Helen Aston, for generous assistance and advice on the manuscript.

Manuscript received 19 July 1983.

LECTOTYPIFICATION OF GENIOSTOMA PETIOLOSUM (LOGANIACEAE)

by

BARRY J. CONN*

ABSTRACT

The upper specimen of MEL 640125 (Moore 47) is here chosen as the lectotype of *Geniostoma petiolosum* C. Moore & F. Muell. and the authorship of this species is discussed.

INTRODUCTION

In my revision of *Geniostoma* (Conn 1980) I discussed the two syntypes of *Geniostoma petiolosum (viz. C. Moore 38* and *47)*. Since Moore was the Director (1848–1896) of the botanical gardens [now Royal Botanic Gardens] at Sydney (Stafleu & Cowan 1981) I expected to find the syntypes at NSW. However, they were not found prior to publication of my revision and were presumed to have been mis-placed (Conn 1980, p. 344). Since then, a thorough search of the NSW collections has failed to locate these specimens. Subsequently, Dr R. Hoogland (*in litt.*) informed me that 'In many cases Moore did not retain specimens in Sydney [NSW]' of the collections he had made from Lord Howe Island. Furthermore, many collections prior to the 1920's with NSW labels (not only from Lord Howe Island) can be found at other herbaria (e.g. A, BM, G, K. L, MEI , NY, P, UC, W, Z) without a duplicate specimen at NSW. Therefore, it is assumed that NSW does not have duplicates of the syntypes of *G. petiolosum*. However, specimens of *Moore 38 & 47* have been located at K and MEL (Conn 1980).

LECTOTYPIFICATION

Moore 38 is a sterile collection whereas *Moore 47* is a fruiting one. In the protologue, Moore and Mueller (in Mueller 1869, p. 28) describe the fruit and clearly state that they did not have flowering material ('Fructus 4-5''' longi'. 'Corolla et genitalia ignota'). *Moore 47* is in close agreement with the protologue and so the upper specimen of the MEL sheet of this collection is here chosen as the lectotype of *G. petiolosum* C. Moore & F. Muell.

Geniostoma petiolosum C. Moore & F. Muell., in F. Muell., Fragm. Phytogr. Austr. 7:28 (1869); F. Muell., Fragm. Phytogr. Austr. 9:193 (1875); Val., Bull. Jard. Bot. Buitenzorg 12:16 & 18 (1902); Conn, Blumea 26:343 & 344, Figs. 19F-J (1980). TYPE: 'In insula Lord Howe's Island; C. Moore'. LECTOTYPE (here chosen): *C. Moore 47, s. dat.* [-.vii.1869† (Anonymous 1958)], 'Hab. Howe's Island. Large shrub, 10 to 15 feet' (MEL 640125 pp., upper specimen). ISOLECTOTYPE: (K; MEL 640125 pp., lower specimen). OTHER SYNTYPES: *C. Moore 38, s. dat.* [-.vii.1869†], 'Hab. Howe's Island. Small shrub of 4 to 6 feet' (K; MEL 640126).

DISCUSSION OF AUTHORSHIP

F. Mueller described several species based on C. Moore's Lord Howe Island collections and a number of species were published under joint authorship. Hoogland *(in litt.)* suggests that the descriptions were all by Mueller only. He also suggests that Mueller included C. Moore as a joint author, in appreciation of Moore's collections on which the

*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria 3141.

†The collection date of *Moore 38 & 47* was incorrectly cited (typographical error) as '-.xii.1869' in Conn (1980, p. 343).

Muelleria 5(4): 263-264 (1984).

various new species were based. Since this was frequently the custom of the last century, it is likely that Hoogland's interpretation is correct. However, it is clear that Mueller intended to co-author these various species (in particular *G. petiolosum*) with Moore (e.g. Mueller 1889). According to the "Australian Encyclopaedia" (Anonymous 1958, p. 143) 'He [C. Moore] collaborated with Baron von Mueller . . . in describing several of the unusual plants found there [Lord Howe Island]'. Unfortunately we are unable to evaluate the extent of this collaboration because most of Mueller's official correspondence was destroyed about 1934 during the shift from the old Botanical Museum to the present building of the National Herbarium of Victoria (Pescott, 1982). Since there is no supplementary evidence contemporaneous with Moore's collections to prove otherwise, the protologue must be accepted. Therefore C. Moore and F. Mueller are regarded as joint authors of *Geniostoma petiolosum*.

ACKNOWLEDGEMENTS

I extend my sincere thanks to Dr R. Hoogland for his valuable information on the collections of C. Moore.

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Manuscript received 12 July 1983.

NYMPHOIDES TRIANGULARIS AND N. ELLIPTICA (MENYANTHACEAE): TWO NEW AUSTRALIAN SPECIES

by

HELEN I. ASTON*

ABSTRACT

Two new species of *Nymphoides* Séguier, *N. triangularis* and *N. elliptica*, are described and illustrated and notes on distribution, habitat and diagnostic features are provided. Both species are from Cape York Peninsula, Queensland, Australia.

TAXONOMY

This paper is the second precursor to a revision of *Nymphoides* Séguier in Australia. The previous paper, describing five new species, appeared in *Muelleria* 5(1):35–51 (1982). With two slight modifications concerning style type and corolla tube length, the common characters given on page 35 of that paper also apply to *N. triangularis* and *N. elliptica*. Both species belong in the "indica group" defined on the same page.

Nymphoides triangularis H. I. Aston, sp. nov.

Nymphoides sp. nov. "E", Aston in litt.

Plantae annuae. Laminae foliorum (13-) 30–65 x (12-) 17–50 mm, ovatae usque anguste vel late triangulares, singulae sinu basali profundo acuto; lobi et apex obtusi. Inflorescentia fasciculum densum pedicellorum formans, a folio singulari subtenta; petiolus folii subtendentis plerumque laminam aequans vel longior. Flores heterostyli, (4)5(6)-partiti. Corolla 14-26 mm diametro, alba vel pallide rosea vel pallide malvino-rosea, fauce flavo; lobi duabus alis latis lateralibus profunde laciniatis praediti (alis ab apice paene usque basin extendentibus) et proxime super basin fimbriis conspicuis transversis papillarum tenuium ornati; tubus fasciculo pilorum subtilium pluriramantium instructus (pili 1-2.5 mm longi, secundum lineam mediam quisque inter bases filamentorum). Stylus florum longistylium c. (3.1-) 4.3-5.8 mm longus. Stigma florum longistylium ± ellipticum. Capsula anguste usque late ellipsoidea. Semina 23-63 per capsulam, paene globosa sed parce usque modcratim latcraliter compressa, 0.45-0.70 x 0.45-0.65 x 0.25-0.55 mm, maturitate atrofusca, tuberculis obtusis brevissimis velata (vel tubercula juxta margines seminis solum occurrentes); caruncula basalis, rotunda, pallida, crassa, conspicua.

Ob petiolum longum folii peculiaris (quod inflorescentiam subtendit) et ob pilos longos subtiles ramificatos *N. ellipticae* similis, sed abilli specie differt: seminum numero sculpturaque, loborum corollae figura, styli longitudine et stigmatis forma in floribus longistylosis, atque laminae typicae foliorum forma.

Apparently annual. *Petiole-like stems* few to many, arising from the plant base, slender, flexuose, 3 cm (plants on mud) to 40 cm (plants in water) long x 1 mm or less diam.; true petiole conspicuous, (0.5-) 1.75-7 cm long, usually as long as or longer than the blade, equal in width to the stem and like it often deep maroon-purple. *Leaf blade* obtuse, entire, ± ovate to narrow- or broad-triangular in outline, with a pronounced, usually acute, basal sinus; sinus (20-) 30-45 (-50)% of total blade length, of (20°-) 35°-75° (-90°) angle; basal lobes obtuse; blade (13-) 30-65 x (12-) 17-50 mm, usually widest across the basal lobes close to their extremities, sometimes widest close to the petiole insertion, green above, sometimes purplish beneath, not spongy. *Inflorescence* as for the "indica group", the pedicels subtended by acute bracts 1-4 mm long and clustered on a rachis which is at first not pronounced but which may develop into a conspicuous projection 5-10 mm long x 2-2.5 mm wide with the older fruited pedicels fallen from its proximal portion. *Pedicels* (5-) 15-25 simultaneously present, noticeably distanced from the subtending leaf blade by the conspicuous petiole, very slender, (10-) 35-75 x <0.5 (-0.75) mm, usually pale to deep maroon-purple. *Flowers* (4)5(6)-partite. *Calyx lobes* lanceolate to narrow-ovate, acute, greenish or purplish with narrow translucent margins,

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Muelleria 5(4): 265-270 (1984).

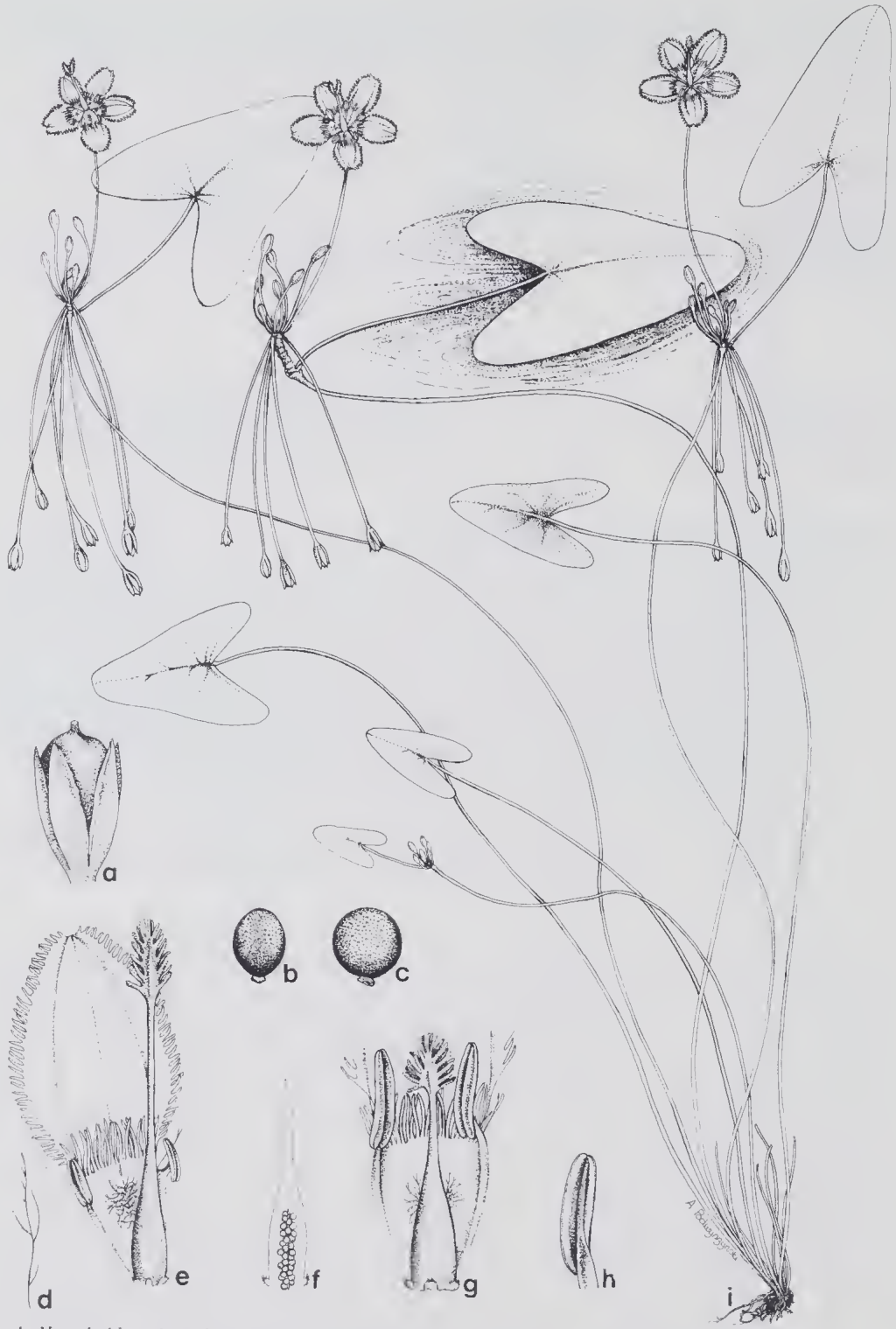

Fig 1. *Nymphoides triangularis*. a — capsule and persistent calyx, x 4. b — seed, edge view, x 13. c — seed, face view, x 13. d — hair from the corolla tube clusters, x 16. e — portion of long-styled flower, x 5.5. f — ovary, L.S. showing the position of one of the placentas, x 5.5. g — portion of mid-styled flower, x 5.5. h — anther, dorso-latcral view showing connective and versatile attachment, x 13. i — habit, x 0.7. All from Aston 2262(MEL).

often outcurved at the apex in fruit, (3-) 4.5-6.5 mm long. *Corolla* 14-26 mm span, c. 3 times as long as the calyx, white or white tinged with very pale pink or mauve-pink, the tinge deeper on the external surface of the mid-section of the lobes; tube yellow. *Corolla lobe* broad-elliptic to rotund; mid-section glabrous except for a conspicuous transverse fringe of fine papillae 1.2-2.5 mm long just above its base; side-wings broad, undulate, deeply laciniate, extending from the apex almost to the lobe base. *Corolla tube* equal to or a little > calyx; tube "papillae" consisting of a conspicuous cluster of long, fine, sessile, several-branched hairs 1-2.5 mm long. *Stamens* with filaments c. 0.5-0.7 and 1.2-1.7 mm long in long-styled and mid-styled flowers respectively; anthers broad-linear, 3-4 times as long as broad, 1-1.9 mm long. *Gynoecium (long-styled flower)* c. 6-10 mm long; ovary very narrow-ellipsoid, gradually tapered into the style; placentas 2, about one-half to two-thirds of the ovary length, positioned centrally or from centre to base down the ovary wall; ovules c. 23-72; style c. (3.1-) 4.3-5.8 mm long, very slender; stigmas 2, each an erect, ± elliptic to broad-elliptic, papillate, strongly laciniate wing c. 2 mm long. *Gynoecium (mid-styled flower)* c. 4-7 mm long; style c. 1.2-2.3 (-3.5) mm long; stigmas 0.9-1.5 mm long, broad-elliptic to rounded. *Capsule* narrow- to broad-ellipsoid, from a little < to equal to (occasionally slightly >) the calyx, (3.0-) 3.5-5 mm long. *Seeds* 23-63 per capsule; body of seed near-globose but slightly to moderately laterally compressed, 0.45-0.70 mm long x 0.45-0.65 mm wide x 0.25-0.55 mm thick, dark grey-brown-black when mature, moderately densely covered with very short obtuse tubercles or else having the faces smooth with the tubercles present only on and close to the seed edges and gradually diminishing in length from the edge towards the face; basal caruncle circular, pale, ± thick and conspicuous.

TYPE COLLECTION:

14.8 km east of "Musgrave" along the "Marina Plains" road, 14° 44′ S., 143° 37′ E., Cape York Peninsula, Queensland, 13.v.1982, *Aston 2262* (Holotype: MEL 612194. Isotypes: BRI, CANB, MEL 612195 and 196).

SELECTED SPECIMENS EXAMINED (total 7):

Queensland (Cape York Peninsula) — Codroy Creek, 5.3 km NW of the Hann River crossing of the Laura to Coen road, 15° 10′ S., 143° 50′ E., 11.v.1982, *Aston 2246* (BRI, CANB, DNA, K, MEL 612182-186, NSW). 3.2 km E of "Musgrave" along the "Marina Plains" road, 14° 46′ S., 143° 31′ E., 13.v.1982, *Aston 2256* (BRI, MEL 612187-189). 4.5 km E of the Aurukun-Beagle North Camp road and 6.8 km S of Cowplace Creek, 13° 15′ S., 141° 53′ E., 1.vi.1982, *Clarkson 4459* (BRI (not seen), MEL 609390). 10 km E of the Edward River Settlement, 14° 50′-55′ S., 141° 40′-45′ E., 5.iv.1981, *Garnett s.n.* (MEL 1521027).

DISTRIBUTION:

Queensland — Known only from the Aurukun, Edward River, "Musgrave" and Hann River areas of Cape York Peninsula. Almost certainly occurs elsewhere on the peninsula in similar habitat.

HABITAT:

Clear, still to gently flowing fresh water 5-25 cm deep on sandy substrate in seasonally flooded swamps and small ephemeral streams through *Melaleuca* woodland. Temporarily persists as small, more or less erect, depauperate plants on drying mud left by receding waters. Fl. and Fr. recorded 5 April-22 June.

NOTES:

Readily recognised as a member of the "indica group" by the white to pale pink flowers (yellow only in the throat) and the clustered inflorescence arising from the apparent petiole. *Nymphoides triangularis* and the following species *N. elliptica* both differ from all other species of that group in having the blade of the inflorescence-subtending leaf distanced from its inflorescence cluster by a long conspicuous petiole and in having the "papillae" clusters of the corolla tube comprised of long fine branched hairs.

The non-spongy leaves, moderately large 5-partite flowers and the lack of a central keel on the corolla lobe are other notable characters shared by *N. triangularis* and *N.*

elliptica although not confined to them. The two species may be similar at first sight but *N. triangularis* differs in its smaller, more numerous, differently sculptured seeds, its deeply laciniate rather than ± entire corolla lobes, its longer slender style and ± elliptic rather than deltoid stigmas of the long-styled flowers and in the ± triangular rather than elliptic outline of the most typical leaf blades. The comparatively long and narrow corolla tube of *N. triangularis* may prove to be another distinctive feature.

Both *N. triangularis* and *N. elliptica* have long-styled flowers and also flowers which appear mid-styled, the anthers of the latter being held from very slightly above to very slightly below the level of the stigmas; no definitely short-styled flowers have been found but this may be due to insufficient collections or observations.

The epithet *triangularis* refers to the most characteristic outline of the leaf blades.

Nymphoides elliptica H. I. Aston, sp. nov.
Nymphoides sp. nov. "C", Aston in litt.

Plantae annuae. Laminae foliorum (15-) 30-85 x (10-) 20-60 mm, anguste usque late ellipticae vel ovato-ellipticae, singulae sinu basali profundo acuto. Inflorescentia fasciculum densum pedicellorum formans, a folio singulari subtenta; petiolus follii subtendentis plerumque laminam aequans vel longior. Flores heterostyli, (4)5-partiti. Corolla 14-25 mm diametro, alba vel pallide rosea vel pallide malvino-rosea, fauce flava; lobi duabus alis latis lateralibus praediti (alae integrae nisi crenulae vel dentes ad apicem vel apicem versus), et proxime super basin fimbriis conspicuis transversis papillarum tenuium ornati; tubus fasciculo pilorum subtilium pluriramantium instructus (pili 0.8-1.3 mm longi, secundum lineam mediam quisque inter bases filamentorum). Stylus florum longistylium c. 1.5-2.5 mm longus. Stigma florum longistylium latum, deltoideum usque rhomboideum. Capsula ellipsoidea usque late ellipsoidea. Semina 5-15 per capsulam, paene globosa sed parce usque moderatim lateraliter compressa, 1-1.3 (-1.5) x 1-1.3 x 0.85-1.1 mm, maturitate atrofusca, omnino foveolata, rugis reticulatis inter foveolas (foveolae atque rugae tuberculis brevibus tenuibus obtusis omnino dense velatae); caruncula basalis, rotunda, pallida, crassa, conspicua.

Ob petiolum longum folii peculiaris (quod inflorescentiam subtendit) et ob pilos longos subtiles ramificatos *N. triangularis* similis, sed abilli specie differt: seminum numero sculpturaque, loborum corollae figura, styli longitudine et stigmatis forma in floribus longistylosis, atque laminae typicae foliorum forma.

Apparently annual. *Petiole-like stems* few to many, arising from the plant base, slender, flexuose, 8 cm (plants on mud) to 79 cm (plants in water) long x 1.5 mm or less diam.; true petiole conspicuous, (1-) 2.5-14 cm long, usually as long as or longer than the blade, equal in width to the stem and like it often maroon-purple. *Leaf blade* obtuse, entire, narrow- to broad-elliptic or ovate-elliptic in outline, with a pronounced, acute, basal sinus; sinus 30-45 (-50)% of total blade length, of (2°-) 20°-40° (-50°) angle and sometimes with the proximal portions of the obtuse basal lobes overlapping by up to 10°; blade (15-) 30-85 x (10-) 20-60 mm, widest at or slightly above (rarely below) the petiole insertion, green above, sometimes purplish beneath, not spongy. *Juvenile leaves* basal, submerged, very thin-textured; blades ovate to deltoid, 10-22 mm long; petioles flattened, 10-26 mm long. *Inflorescence* as for the "indica group", the pedicels subtended by acute bracts 1-6 mm long. *Pedicels* (7-) 10-22, noticeably distanced from the subtending leaf blade by the conspicuous petiole, very slender, (15-) 35-85 x < 0.5-1 mm, usually pale to deep maroon-purple. *Flowers* (4)5-partite. *Calyx lobes* linear-lanceolate to lanceolate, acute to obtuse, greenish or purplish with narrow translucent margins, sometimes outcurved at the apex in fruit, (3.5-) 4-6.5 mm long. *Corolla* 14-25 mm span, c. 2.5 times as long as the calyx, white or white tinged with very pale pink or mauve-pink, the tinge deeper on the external surface of the mid-section of the lobes; tube yellow. *Corolla-lobe* broad-elliptic-oblong to obovate; mid-section glabrous except for a transverse fringe consisting of a single row of fine papillae c. 1-1.5 (-2) mm long just above its base; side-wings broad, undulate, entire except for small crenations or teeth at the apex or along the distal third or half. *Corolla tube* usually a little < calyx; tube "papillae" consisting of a conspicuous cluster of fine, sessile, several-branched hairs 0.8-1.3 mm long. *Stamens* with filaments c. 0.2-0.3 and 0.7-0.9 mm long in long-styled and mid-styled flowers respectively; anthers broad-linear, 2.5-4 times as long as broad, 0.9-1.7 mm long. *Gynoecium (long-styled flower)* c. 6-8 mm long; ovary ± ellipsoid-conical, gradually tapered into the style; placentas 2, from minute to one-third or

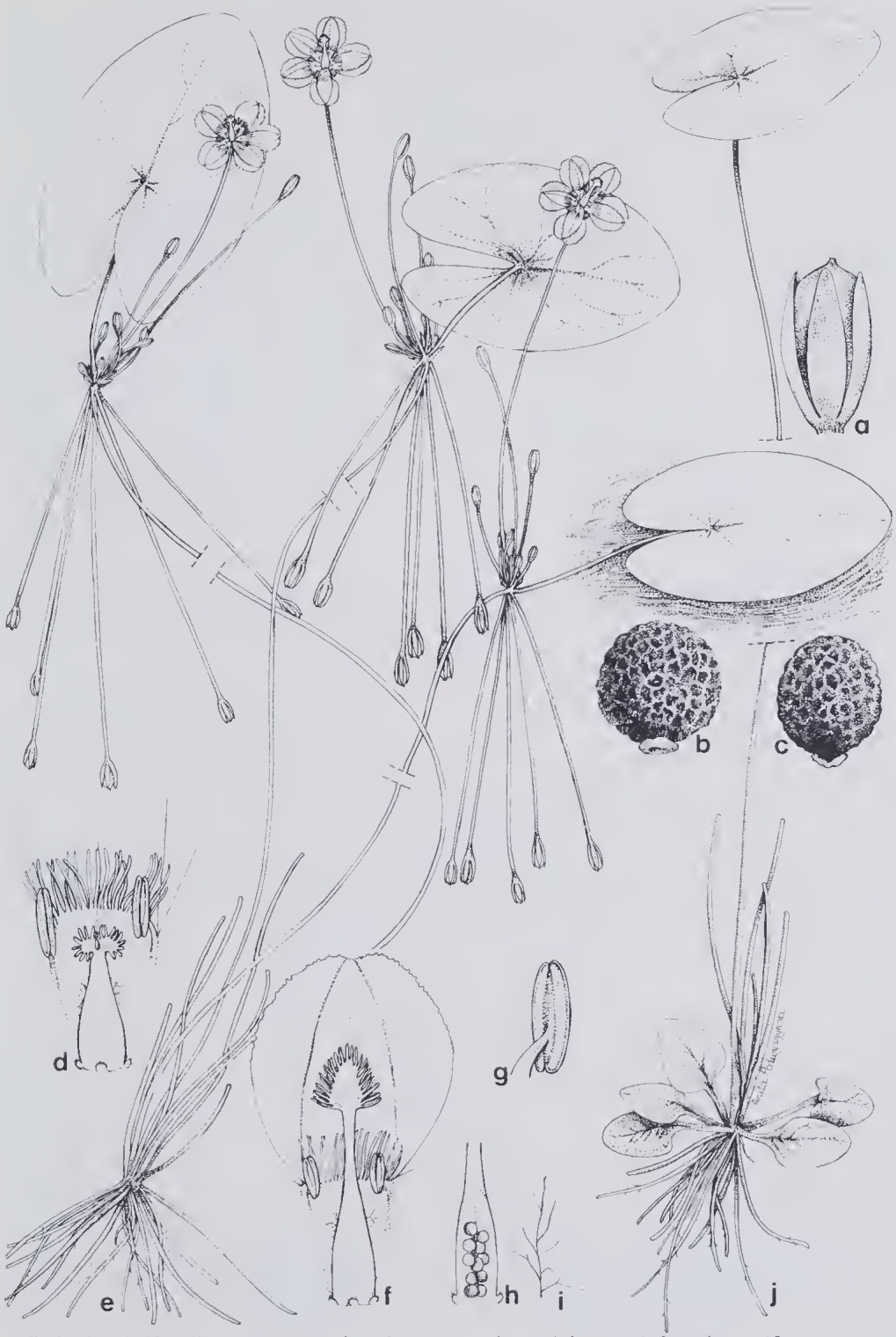

Fig 2. *Nymphoides elliptica*. a — capsule and persistent calyx, x 4. b — seed, face view, x 13. c — seed, edge view, x 13. d — portion of mid-styled flower, x 5. e — habit, x 0.7. f — portion of long-styled flower, x 5. g — anther, dorsal view showing connective and versatile attachment, x 13. h — ovary, L.S. showing the position of one of the placentas, x 5. i — hair from the corolla tube clusters, x 16. j — young plant, showing submerged juvenile leaves at base, x 0.7. All from Aston 2260(MEL).

one-half of the locule length and centrally positioned down the ovary wall; ovules c. 5-17; style c. 1.5-2.5 mm long; stigmas 2, each an erect, broad-deltoid to broad-rhomboid, papillate, strongly laciniate wing c. 2-3 mm long and broad. *Gynoecium (mid-styled flower)* c. 3-5 mm long; style c. 0.3-0.8 (-1) mm long; stigmas 0.8-1.6 mm long, usually somewhat broader than long, each dissected almost to the base into many laciniae. *Capsule* ellipsoid to broad-ellipsoid, from a little < to a little > the calyx, (4-) 4.5-6 (-6.5) mm long. *Seeds* 5-15 per capsule; body of seed near-globose but slightly to moderately laterally compressed, 1-1.3 (-1.5) mm long x 1-1.3 mm wide x 0.85-1.1 mm thick, dark grey-brown-black when mature, pitted all over, the pits and the reticulate ridging between them all densely covered with short fine obtuse tubercles; basal caruncle circular, pale, thick and conspicuous.

TYPE COLLECTION:

10.3 km east of "Musgrave" along the "Marina Plains" road, 14° 45′ S., 143° 35′ E., Cape York Peninsula, Queensland, 13.v.1982, *Aston 2260* (Holotype: MEL 612197. Isotypes: BRI, CANB, K, MEL 612198 and 199).

SELECTED SPECIMENS EXAMINED (total 5):

Queensland (Cape York Peninsula) — 2.2 km E. of "Musgrave", 14° 47′ S., 143° 31′ E., 13.v.1982, *Aston 2253* (BRI, CANB, K, MEL 612190-193, NSW, PERTH). 9.6 km S. of the Sefton-Oroners road on the track to Koolatah, 15° 33′ S., 142° 42′ E., 29.vi.1981, *Clarkson 3781* (BRI, K, MO, NT, PERTH, QRS (all not seen); MEL 590450!). Edward River Settlement area, c. 14° 53′ S., 141° 37′ E., vii.1981, *Bredl s.n.* (MEL 641986; MEL spirit collection 484/B).

DISTRIBUTION:

Queensland — Known only from the Edward River, Alice River, "Musgrave" and North Kennedy River areas of Cape York Peninsula. Almost certainly occurs elsewhere on the peninsula in similar habitat.

HABITAT:

Clear, still to gently flowing fresh water 5-60 cm deep on sandy substrate in seasonally flooded swamps and edging small ephemeral streams through *Melaleuca* woodland. Temporarily persists as small depauperate plants on drying mud left by receding waters. Fl. and Fr. recorded 15 April-29 June.

NOTES:

Readily recognised as a member of the "indica group" by the white to pale pink flowers (yellow only in the throat) and the clustered inflorescence arising from the apparent petiole. For differences from other species see under *N. triangularis*, notes.

The epithet *elliptica* refers to the most characteristic outline of the leaf blades.

ACKNOWLEDGEMENTS

Mr J. R. Clarkson, botanist at the Mareeba branch of the Queensland Herbarium, provided facilities and regional information for my field work on Cape York Peninsula in 1982 and has willingly watched for and collected *Nymphoides* during his own extensive field work on the Cape. Mr and Mrs R. Bredl (Edward River) and Mr S. T. Garnett (James Cook University, Townsville) responded to my request for additional collections from Edward River and Dr B. R. Jackes (JCT) liaised on my behalf concerning plants of that region. The Chairman and members of the Edward River Settlement granted permission for me to visit and collect at the Settlement but unfortunately late rains prevented the visit. Dr. J. H. Willis, Brighton, Victoria, prepared Latin descriptions from the English draft and Miss A. Podwyszynski of the National Herbarium of Victoria provided the illustrations. I am most grateful to all of these people for their assistance. In addition, I wish to thank Mrs T. Kloot of Melbourne and Mr S. Trezise of Laura for their help and pleasant companionship in the field during my searches in 1982.

Manuscript received 27 May 1983.

THREE NEW AUSTRALIAN LICHENS: CLADONIA CELATA, C. PRAETERMISSA AND C. WILSONII

by

ALAN W. ARCHER*

INTRODUCTION

During the preparation of a preliminary key to the lichen genus *Cladonia* (Division Eumycota, Order Lecanorales, Family Cladoniaceae) in Australia, many specimens from various localities were found to differ significantly, both chemically and morphologically, from known species. These specimens were separated, on the basis of different morphology and chemistry, into three homogenous groups containing respectively fumarprotocetraric acid, atranorin and fumarprotocetraric acid, and atranorin and stictic acid, and are here differentiated and assigned to three new species. Acetone extracts from all specimens were examined by thin-layer chromatography, using the mobile phases described by Culberson (Culberson, 1972) and the separated compounds were detected with sulphuric acid (Culberson, 1972) and MBTH (Archer, 1978).

TAXONOMY

Cladonia celata A. W. Archer, sp. nov.

Thallus primarius squamulis, 0.4-1 mm latis, 0.5-2 mm longis, supra cinereo-glaucescentibus, infra albis, nullis sorediis. Podetia ascendentia squamulis, corticata, 5-15 mm alta, initio simplicia, ramosescens irregulariter, denique fastigiata, vel formantes scyphos deformes prolificationibus marginalibus; pycnidiis terminalis fasciculatis. Apothecia et ascosporae non visa. Thallus K −; KC −; Pd +, rubescens; acidum fumarprotocetraricum continens.

Primary thallus with small squamules, 0.4-1 mm wide, 0.5-2 mm long, rounded, inconspicuous, green above, white below. *Podetia* arising from the squamules, rough corticate, esorediate, esquamulose, 5-15 mm tall, at first simple then branching irregularly, finally fastigiately, or forming deformed scyphi with marginal proliferations in the form of smaller scyphi; podetia with terminal clusters of pale brown to brown pycnidia. *Apothecia* and *ascospores* not seen. Thallus K −; KC −; PD +, red; containing fumarprotocetraric acid.

TYPE COLLECTION:

Australia, New South Wales, Tinderry Range, on soil by side of Captain's Flat Rd., 10 km E. of Michelago, 149° 15′ E., 35° 44 ′ S., alt. ca 1100 m, 15.xi.1981, Archer 1185 (Holotype: MEL 1036217; Isotype: H).

ALSO EXAMINED:

New South Wales — 50 km E. of Glen Innes along Highway 38, alt. 1000 m, 18.viii.1976, J. A. Elix 2444; Kangarooby State Forest, 16 km S. of Gooloogong, alt. 450 m, 10.ix.1980, J. A. Elix 8831; same location as type collection, 15.xi.1981, Archer 1187 (Topotype: NSW).

DISCUSSION:

Cladonia celata (Fig. 1) was found growing on soil in association with *C. wilsonii* (sp. nov., vide infra) and *C. capitellata* (Hook. & Tayl.) Hook. and is known only from three locations in New South Wales. *C. celata* is distinguished from all other Australian *Cladonia* species containing fumarprotocetaric acid by the rough corticate and esorediate podetia and the fastigiate or somewhat scyphose habit with terminal clusters of brown pycnidia. The morphology and chemistry of *C. celata* place it in the infra-generic group *Cladonia*, sub-group *Cladonia*, cf. subsection Thallostelides (Vain.) Matt. (Thomson,

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Muelleria 5(4): 271-275 (1984).

Fig. 1. *Cladonia celata*. Typical specimens showing podetia. Scale in millimetres. From the Holotype.

Fig. 2. *Cladonia praetermissa*. Typical specimens showing basal squamules and podetia. Scale in millimetres. From the Holotype.

1967), using the provisional nomenclature proposed in a recent infra-generic classification of *Cladonia* (Huovinen & Ahti, 1982).

Cladonia praetermissa A. W. Archer, sp. nov.

Thallus primarius squamulis, conspicuis et persistentibus, 6-10 mm longis, 2-5 mm latis, supra cinereo-glaucescentibus et interdum sorediis caducis podetiis, infra albis, marginibus squamularum crenatis vel subincisis. Podetia ascendentia squamulis, simplicia vel raro apicibus ramosis, subulatis vel subcylindricis, 5-15 mm alta (raro 20 mm), 0.3-0.7 mm diam., base corticata, ecorticatescens et sorediis granularibus apicibus; interdum squamulis prope basem. Apothecia et ascosporae non visa. Thallus K +, flavidus; KC −; PD +, rubescens; atranorin et acidum fumarprotocetraricum continens.

Primary thallus of conspicuous and persistent squamules, 6-10 mm long, 2-5 mm wide, above pale green, sometimes with soredia fallen from the podetia, below white, the margins crenate or somewhat incised. *Podetia* arising from the squamules, simple or rarely branching near the tip, subulate or somewhat cylindrical, 5-15 mm tall (rarely to 20 mm), 0.3-0.7 mm diam., corticate at the base and becoming ecorticate and granular sorediate to the tip; sometimes squamulose near the base. *Apothecia* and *ascospores* not seen. Thallus K +, weak yellow; KC −; PD +, red; containing atranorin and fumarprotocetraric acid.

Type Collection:

Australia, New South Wales, Epping, near track by side of Devlin's Creek, 151° 05′ E., 33° 45′ S., alt. ca 80 m, 18.vii.1982, Archer 1376 (Holotype: MEL 1036220; Isotype: H, NSW).

Also Examined:

Western Australia — Mt. Barker, 50 km N. of Albany, 117° 40′ E., 34° 35′ S., alt. 300 m, 10.x.1980. Archer 1467 (NSW).

South Australia — 4 km W. of Carey Gulley, Mount Lofty Ranges, alt. 456 m, 21.xii.1976, J. A. Elix 2845.

Queensland — Coochiemudlo Island, 50 km E. of Brisbane, 153° 20′ E., 27° 34′ S., alt. ca 10 m, 9.v.1982, Archer 1330A (MEL 1036221, NSW).

New South Wales (selected specimens only, 5/13) — 0.5 km W. of Surf Beach, Batehaven, alt. 4 m, 14.ix.1975, J. A. Elix 1236; 3 km E. of Blackheath, alt. ca 800 m, 30.xii.1980, Archer 1017 (NSW); Tinderry Range, 10 km E. of Michelago, alt. ca 1100 m, 15.xi.1981, Archer 1222B (NSW); Mt. Kaputar, 150° 09′ E., 30° 17′ S., alt. ca 1300 m, 13.x.1981, Archer 1269 (NSW); Lane Cove River, near junction with Devlin's Creek, 151° 06′ E., 33° 46′ S., alt. ca 60 m, 16.x.1982, Archer 1401 (Topotype: H, NSW).

Norfolk Island — Mt. Pitt Reserve, 167° 56′ E., 29° 04′ S., alt. ca 130 m, coll. R. Goldsack, 25.xii.1981, Archer 1226 (NSW).

Discussion:

Cladonia praetermissa (Fig. 2) is a common but overlooked species growing on sandy soil in moist, semi-shaded positions. The chemistry is similar to that of the South American *C. ceratophylla* (Sw.) Spreng. but the new species is distinguished from *C. ceratophylla* by the absence of marginal rhizines on the basal squamules and the absence of isidioid, terete squamules on the podetia. *Cladonia ceratophylla* was reported to occur in New South Wales by Krempelhuber (Mueller, 1881) who examined specimens sent to him by F. Mueller in Melbourne. However, the specimen examined by Krempelhuber may have been *C. praetermissa* as *C. ceratophylla* is apparently endemic to South America.

Cladonia praetermissa is separable from all other Australian *Cladonia* with granular sorediate podetia by the presence of atranorin, and is distinguished from all other Australian *Cladonia* containing atranorin and fumarprotocetraric acid by its short, simple, sorediate podetia in contrast to the scyphose podetia of *C. conoidea* Ahti, *C. krempelhuberii* (Vain.) Zahlbr. and *C. subcervicornis* (Vain.) Kernst. and the esorediate podetia of *C. corymbescens* Nyl. ex Leighton and *C. ecmocyna* Leighton.

Cladonia praetermissa may be placed in the infra-generic group *Cladonia*, sub-group *Foliosae* (Huovinen & Ahti, 1982).

Cladonia wilsonii A. W. Archer, sp. nov.

Thallus primarius squamulis, persistentibus vel evanescentibus, 1-2 mm longis, 0.5-1.0 mm latis, supra cinereo-glaucescentibus, infra albis, nullis sorediis. Podetia ascendentia squamulis, 10-25 mm alta, albida, nullis scyphis, ramosa, subfindescentia, cortice continuo subgranularescenti. Apothecia ad apices podetiorum, fusca, convexa, 0.3-0.7 mm diam.; ascosporae 8 per ascum, incolores, simplices, ellipsoideae, 11-14 µm longae, 3-4 µm latae. Thallus K +, flavidus; KC −; Pd +, flavescens; atranorin et acidum sticticum continens.

Primary thallus with squamules, persistent or evanescent, 1-2 mm long, 0.5-1 mm wide, green above, white below, esorediate. *Podetia* arising from the squamules, 10-25 mm tall, whitish, lacking scyphi, branching and splitting; *cortex* continuous becoming somewhat granular, esorediate. *Apothecia* on the tips of the podetia, dark brown to reddish-brown, convex, 0.3-0.7 mm diam., *ascospores* eight per ascus, colourless, simple, ellipsoid, 11-14 µm long, 3-4 µm wide. Thallus K +, weak yellow; KC −; Pd +, yellow; containing atranorin and stictic acid.

Type Collection:

Australia, Australian Capital Territory, 35 km SSW. of Canberra, on soil by side of Corin Dam Rd., near Kangaroo Creek, alt. ca 1000 m, 2.v.1982, Archer 1315C (Holotype: MEL 1036222; Isotype: H, NSW).

Also Examined:

Western Australia — 80 km N. of Albany, track to Toolbrunnup Peak, 118° 03′ E., 34° 22′ S., alt. ca 750 m, 30.ix.1980, Archer 948 (MEL 1036216, NSW).

New South Wales — 10 km E. of Michelago, Tinderry Range, 149° 15′ E., 35° 44′ S., alt. ca 1100 m, 15.xi.1981, Archer 1189B (MEL 1036218, NSW).

Australian Capital Territory — Near Tidbinbilla River, 148° 25′ E., 35° 27′ S., alt. ca 850 m, 9.iv.1982, Archer 1291A (NSW); Tidbinbilla, Fishing Gap Fire Trail, 148° 52′ E., 36° 29′ S., alt. ca 900 m, 9.iv.1982, Archer 1302A (NSW); Smoker's Gap, Corin Dam Rd., alt. ca 1200 m, 2.v.1982, Archer 1318 (NSW).

Tasmania — 14 km WSW. of Geeveston, 146° 46′ E., 43° 12′ S., alt. ca 800 m, 28.xi.1982, Archer 1408 (H, HO 59009, MEL 1036211).

Discussion:

The species is named after F. R. M. Wilson (1832–1903), an early Australian lichenologist. *Cladonia wilsonii* (Fig. 3) is found growing on soil in semi-exposed positions, often in association with *Cladonia diffissa* (F.Wils.) F.Wils.; both species are usually found with abundant apothecia. The species is differentiated from the somewhat similar *C. diffissa* by the presence of stictic acid. In addition, it appears to be limited to altitudes above 700 m, whereas *C. diffissa* occurs both above and below 700 m. When examined by thin-layer chromatography, using solvent G (Culberson et al., 1981), *C. wilsonii* was found to contain traces of constictic, cryptostictic and norstictic acids in addition to the two major lichen compounds, atranorin and stictic acid. The chemistry and morphology of *C. wilsonii* place the species in the infra-generic group *Helopodium* (Huovinen & Ahti, 1982).

ACKNOWLEDGEMENTS

The author is grateful to J. A. Elix (Chemistry Department, Australian National University) for the opportunity to examine his specimens, and to the Director, Division of Analytical Laboratories, Department of Health, New South Wales, for permission to publish this paper.

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Fig. 3. *Cladonia wilsonii*. Typical specimens showing podetia with apothecia. Scale in millimetres. From the Holotype.

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THE APPLICATION OF THE NAME TEMPLETONIA SULCATA (Meissn.) Benth. AND A NEW SPECIES OF TEMPLETONIA R.Br. (PAPILIONACEAE) FROM WESTERN AUSTRALIA

by

J. H. Ross*

ABSTRACT

The correct application of the name *Templetonia sulcata* (Meissn.) Benth. is established and *T. smithiana* sp. nov. is described from Western Australia.

INTRODUCTION

The existence of two closely related taxa among the plants traditionally referred to *T. sulcata* in Western Australia and the resulting uncertainty concerning the correct application of the name *T. sulcata* were discussed previously (Ross, 1982). Subsequent field studies have clarified this situation.

THE APPLICATION OF THE NAME T. SULCATA

The two taxa in Western Australia traditionally referred to *T. sulcata* differ in pod size and in seed size, shape and colour; the taxon with large pods having pods 2-2.8 cm long and 0.95-1.5 cm wide and the taxon with small pods having pods 0.75-1.8 cm long and 0.4-0.8 cm wide. When the earlier work was undertaken (Ross, l.c.) the two taxa could not be distinguished with confidence in the absence of mature pods, despite the presence of other differential tendencies, and the uncertainty over the correct application of the name *T. sulcata* arose because Preiss 1028, the type of *T. sulcata*, is a flowering specimen with immature pods. The small-podded and large-podded taxa occur sympatrically in some areas and the type locality of *T. sulcata* near York is within the area where both taxa might be expected to occur.

In response to a request for assistance, Basil and Mary Smith of Wongan Hills spent a considerable amount of time and effort in the field collecting, recording and observing populations of *T. sulcata*. Plants were tagged, sprayed with insecticide to ensure that developing pods reached maturity, and revisited. It was thought unlikely that *T. sulcata* had survived in the vicinity of York as the Avon River valley has been farmed intensively for over a century but aerial reconnaissance by Basil Smith identified several possible habitats. Subsequent visits to these areas by road revealed good populations at Mt. Hardy east of York and between the Avon and Dale rivers near Dale Bridge south of York. This paper is based on the Smith's efforts supplemented by my own field studies and the examination of herbarium collections.

Observations in the Lake Moore, Manmanning, Cowcowing, Southern Cross and York areas confirmed that the two taxa can be differentiated readily by pod size and by seed size and shape. Plants either have large pods containing large seeds (10-16 mm long, 6-9 mm wide) or small pods containing small seeds (4-5.5 mm long, 2.2-3 mm wide). Furthermore, large pods occur on large plants (mostly 1.7-3.2 m high) and small pods on small plants which seldom exceed 1.8 m in height. There is no discontinuity in the size of the large-podded and small-podded plants and, of course, when young, the large-podded plants are small. Although large- and small-podded plants occur sympatrically, they tend to have slightly different ecological preferences and in no instance were mixed populations of large- and small-podded plants observed. The large-podded plants favour sandy loam rises near salt lakes and the small-podded plants favour clay or sandy soils and

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Muelleria 5(4): 277-288 (1984).

usually occur with *Eucalyptus salmonophloia*. The small-podded plants are usually more intricately branched and denser than the large-podded plants. In the field the habit and stature of the plants enable the two taxa to be recognized with little difficulty and provide a fairly reliable means of predicting pod size.

As a result of field observations and the re-examination of type material and other herbarium collections, I am satisfied that the name *T. sulcata* applies to the taxon with small pods which is widespread in southern Western Australia, and occurs also in South Australia, Victoria and New South Wales. The representative specimens of the taxon with small pods cited in Ross, l.c.:28 are referable to *T. sulcata*. *Bossiaea rossii* F. Muell., Fragm. Phyt. Austr. 3:94 (1862), discussed and lectotypified in Ross, l.c. 27–28, is a synonym of *T. sulcata*.

In an endeavour to obtain supplementary evidence in support of the decision concerning the application of the name *T. sulcata* I took up an offer by Dr. F. G. Lennox, C/- School of Botany, University of Melbourne, to study the polyphenols in stem extracts by means of thin-layer chromatography. A stem sample 1.5 cm long was taken from nine different specimens, the specimens representing contemporary material of the small-podded and the large-podded taxa and the two type sheets of *T. sulcata* in MEL. The nine samples were submitted to Dr. Lennox who employed the method to extract the polyphenols from the stem samples outlined in Calder et al. (1982). The polyphenol samples were developed in one dimension with 15% acetic acid using "Merck TLC aluminium sheet cellulose F_{254}" as the support medium.

The fluorescent patterns obtained from the polyphenols divided the nine samples into two groups, one group corresponding to the samples from the specimens with small pods and the other to the samples from the specimens with large pods. The patterns exhibited by the two samples from the type material of *T. sulcata* matched the patterns shown by the samples of the small-podded taxon.

T. sulcata and the taxon with large pods are unquestionably closely allied and their differentiation in the absence of mature pods is difficult on occasions. However, the latter merits formal taxonomic recognition and, because the seeds are significantly different, specific rank seems appropriate. It affords me much pleasure to name this species *T. smithiana* in honour of Basil and Mary Smith.

T. SMITHIANA

Templetonia smithiana J. H. Ross, sp. nov., T. sulcatae (Meissn.) Benth. affinis, a qua leguminibus majoribus et seminibus majoribus ellipticis brunneis et ochro-brunneis differt.

Frutex usque ad 3.2 m altus, aphyllus, glaber; rami complanati, 3.5-9 mm lati, longitudinaliter striati, apicibus acutiusculi vel saepe spinescentes. Stipulae inconspicuae. Flores axillares, solitarii vel gemini; pedicelli usque ad 2 mm longi; bracteolae 1.5-2 mm longae, 1.6-2 mm latae, persistentes. Calyx usque ad 4.3 mm longus. Vexillum oblatum, 5.5-7.5 mm longum, 5.5-7 mm latum, flavescens et atro-purpurascens; alae usque ad 6.5 mm longae et 2.6 mm latae, unguiculatae; carina usque ad 6 mm longa, unguiculata. Stamina 10; filamenta in columnam antice fissam connata. Ovarium glabrum. Legumina oblique obovata vel elliptica, 2-2.8 cm longa, 0.95-1.5 cm lata, coriacea, extus nigro-fusca, compressa sed non complanata. Semina elliptica, complanata, 10-16 mm longa, 6-9 mm lata, brunnea vel ochro-brunnea.

Glabrous leafless *shrub* to 3.2 m high with divaricate flattened branches, the *branches* 3.5-9 mm wide, faintly or distinctly longitudinally striate, the margins notched at the nodes, often terminating in a short spine. *Stipules* inconspicuous. *Leaves* reduced to minute scales up to 1 mm long. *Flowers* 1 or 2 per axil, on glabrous pedicels up to 2 mm long, the pedicels with a pair of ovate papery brown bracteoles 1.5-2 x 1.6-2 mm which overlap the base of the calyx, the bracteoles convex outside, concave within, glabrous or with marginal cilia. *Calyx* up to 4.3 mm long, the lowest lobe often slightly longer than the others, the lobes mostly shorter than the tube, glabrous outside except for hairs on the apices of the lobes. *Standard* oblate, 5.5-7.5 mm long including a claw up to 1.5 mm long, 5.5-7 mm wide, emarginate apically, yellow and purplish-brown; *wings* up to 6.5 mm long including a claw up to 2 mm long, up to 2.6 mm wide, auricled; *keel* petals

up to 6 mm long including a claw up to 2 mm long, up to 2.5 mm wide, auricled. *Stamens* up to 6.5 mm long. *Ovary* shortly stipitate, mostly 4-6-ovulate, glabrous. *Pods* obliquely obovate or elliptic, narrowed to an acute lateral apical beak, 2-2.8 cm long, 0.95-1.5 cm wide, 0.4-0.8 cm thick, shortly stipitate, 1(2)-seeded, valves coriaceous, convex, dark brown, glabrous. *Seeds* elliptic, flattened, 10-16 mm long, 6-9 mm wide, 3-4.5 mm thick, pale brown or yellowish-brown, the hilum surrounded by a collar-like aril.

TYPE COLLECTION: Western Australia, Doodarding, No. 2 Rabbit fence, 0.25 mile N. of gate 44, 31° 01′ S., 117° 12′ E., 13.xii.1982, *B. H. Smith* 204 (MEL 626707 holo., isotypes to be distributed to K, PERTH).

REPRESENTATIVE SPECIMENS EXAMINED:

Western Australia — between Champion and Shark Bay, *F. Mueller* (MEL 565877). Upper Irwin River, xi.1877, *F. Mueller* (MEL 92108). 11.2 km E. of Winchester, 25.xi.1972, *C. Chapman* (PERTH). Mt. Caroline, Upper Swan River, 1886, *G. A. Sewell* (MEL 92107). Near Mt. Collier, 26.iv.1980, *B. H. Smith* (MEL 569227). Lake Moore, 12.xii.1980, *B. H. Smith* (MEL 580090). Koomberkine, 13.xii.1980, *B. H. Smith* (MEL 580089). Cullimbin Reserve, 16 km E. of Manmanning, 4.ix.1982, *J. H. Ross 2768* (MEL 626717). Cowcowing Cemetery, 29.5 km N. of Wyalkatchem on road to Koorda, 4.ix.1982, *J. H. Ross 2769* (MEL 626718). 4.8 km NW of Nalkain, 1.xii.1981, *B. H. Smith* (MEL 602327). Hines Hill, 6.xii.1961, *R. D. Royce 6773* (PERTH). 19.8 miles N. of Vermin Fence on road from Eenuin to Mt. Jackson, 22.xi.1981, *B. H. Smith* (MEL 602329). Great Eastern Highway, near old Southern Cross cemetery, 19.ix.1963, *J. H. Willis* (MEL 566295). Duladgin Rock, 3.ix.1981, *B. H. Smith* (MEL 602326).

T. smithiana is endemic in Western Australia and occurs mainly from south-east of Geraldton to approximately the Great Southern Highway from Perth to York and eastwards to Coolgardie (Fig. 1). It favours sandy loam rises near salt lakes.

The pods and seeds differentiate *T. sulcata* and *T. smithiana* readily (see Ross, l.c.:26, fig. 15). The diagnostic differences are given in Table 1.

It is unfortunate that no reliable floral character has been found to differentiate flowering material of *T. sulcata* and *T. smithiana* but differences in habit and stature and, to some extent ecological preferences, will assist to distinguish the two species. There is a suggestion that flower colour of the two species differs slightly, the flowers of *T. sulcata* being more conspicuously yellow than those of *T. smithiana* which tend to be duller and less obvious. In *T. sulcata* the calyx lobes tend to be acute apically and the ovaries usually contain 2-4 ovules whereas in *T. smithiana* the calyx lobes tend to be obtuse apically and the ovaries 4-6 ovulate.

The occurrence of two closely related leafless species with flattened stems is reminiscent of the relationship that exists between *T. egena* (F. Muell.) Benth. and *T. battii* F. Muell., two leafless species with terete stems.

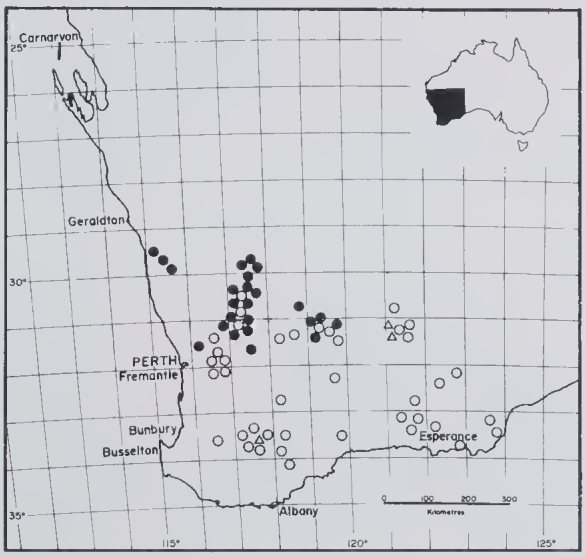

Fig. 1. The known distributions of *Templetonia sulcata* and *T. smithiana* in Western Australia.
○ — *T. sulcata;*
● — *T. smithiana;*
△ — sterile or flowering specimens which cannot be referred to either *T. sulcata* or *T. smithiana* with certainty.

Table 1. Comparison of the diagnostic differences between *T. sulcata* and *T. smithiana*.

	T. sulcata	T. smithiana
pod length	7.5-18 mm	20-28 mm
pod width	4-8 mm	9.5-15 mm
seed length	4-5.5 mm	10-16 mm
seed width	2.2-3 mm	6-9 mm
seed shape	oblong	elliptic
seed colour	deep olive brown	brown or yellowish-brown
aril	conspicuous, margin incised and frilly	less conspicuous than in *T. sulcata* and margin not frilly

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It is a pleasure to acknowledge the contribution of Mr and Mrs B. H. Smith, Wongan Hills, who travelled extensively and carried out field studies over several years on my behalf and provided specimens, observations and colour transparencies. I am most grateful to Mr and Mrs Smith for their hospitality and help in the field during a visit to Western Australia in 1982, to Dr. F. G. Lennox, C/- School of Botany, University of Melbourne, for kindly carrying out thin-layer chromatography of the polyphenols, and to my colleague, Dr P. S. Short, for companionship and help in the field.

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PUBLICATION DATES OF EARLY SCIENTIFIC JOURNALS IN VICTORIA

by

HELEN I. ASTON*

ABSTRACT

The *Victorian Institute for the Advancement of Science*, the *Philosophical Society of Victoria* and the *Philosophical Institute of Victoria* were all predecessors of the present *Royal Society of Victoria*. Between 1854 and 1860 all three bodies published *Transactions* which included papers by Ferdinand J. H. Mueller (1825–1896) of importance to botanical taxonomy. As the dates of publication of these *Transactions* affect botanical nomenclature evidence concerning such dates is presented here.

INTRODUCTION

The Victorian Institute for the Advancement of Science (Vict.Inst.) was founded in Melbourne in July 1854 and the Philosophical Society of Victoria (Philos.Soc.) held its first general meeting in the same city in August of the same year. These two organisations amalgamated in June-July 1855 to form the Philosophical Institute of Victoria (Philos.Inst.). The amalgamated body retained this name until November 1859 when it was granted the Queen's permission to change its title to "The Royal Society of Victoria".

The two original organisations each published one volume of *Transactions*, including proceedings, of their meetings, while the Philosophical Institute published four such volumes before changing its title. The publication dates of these *Transactions* are important for botanical nomenclature as most of the volumes contain articles by Ferdinand Mueller describing new plant species. Those of the two original organisations are particularly critical as names published in one may need to be placed in synonymy under names published in the other, e.g. *Grevillea miqueliana* in *Trans. Vict. Inst.* 1854-55:132 and *G. victoriae* in *Trans. Philos. Soc.* 1:107. The title pages of these two *Transactions* simply state the year 1855.

To determine dates of publication the original minute books of both the Philosophical Society and the Philosophical Institute, containing minutes of both council and general meetings for the period involved were consulted at the premises of the Royal Society of Victoria. Minutes of the Victorian Institute are not held by the Royal Society or the State Library of Victoria and are probably no longer extant. The unpublished minutes, together with reports of general meetings published in the various *Transactions* provided the basic data. For the critical years of 1854 and 1855, involving items A to C in table 1, the Melbourne daily newspapers *The Age*, *The Argus* and *The Melbourne Morning Herald* were searched for additional data, as also were letters from F. Mueller to W. J. Hooker of Kew Herbarium, London. Sundry chance finds in journals of that period were also helpful. No attempt has been made to conduct exhaustive searches of other publications or correspondence as the extra effort involved seems unlikely to yield any further useful refinement of data.

DATES OF PUBLICATION

Summary

Table 1 summarises information concerning the volume and part numbers and the dates of publication of each, for all *Transactions* under consideration. Page numbers given are for the actual "transactions", i.e. the papers read at meetings, as distinct from the business "proceedings" which have been excluded from the table. Unfortunately it has not been possible to prove conclusively which of the critical items A and C appeared

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Muelleria 5(4): 281-288 (1984).

first as the accumulated evidence shows that they were published within a few days of each other or even on the same day. The author's opinion, enlarged upon under "Discussion", is that item C has priority of publication.

Evidence supporting the dates presented in the table is detailed below.

Details

A. Transactions and Proceedings of the Victorian Institute, unnumbered volume.

The title page is dated 1855 and states "for the sessions 1854-1855". There is no volume or part number. The undated preface states that ". . . The collected results [of meetings of the Institute] are now laid before the members; the papers which are read to the Institute are published entire, and an abstract of the Proceedings of the meetings is appended. . . ." It therefore seems that the whole of the *Transactions* were published together at the one time. The date of publication must have been after 7 June 1855, the date of the last meeting of the Victorian Institute, as the account of that meeting appears in the *Transactions*. Although a report of the council presented at a general meeting on 8 March 1855 stated (PM, xv) that papers contributed prior to and including December 1854, the period covered by the council report, "will shortly be published", I have found no evidence of any publication prior to the appearance of the complete volume described here.

The first report of the Council of the Philosophical Institute states (PM2, xxi) that "At the amalgamation of the two societies the funds of each were exhausted in their current expenses, and in the publication of their Transactions." It also states ". . . at the time of the Union [the Victorian Institute was] perfectly free from debt, . . .". This indicates that the *Trans. Vict. Inst.* had been published and paid for by or about the time of amalgamation, i.e. late June to early July 1855 (the first Council meeting of the joint body was 28 June and the first general meeting 10 July). However, other evidence suggests that publication and/or distribution was not effected until some 8 to 10 weeks after amalgamation. Certainly a letter dated 28 June 1855 from F. Mueller to W. J. Hooker, London, shows that *Trans. Vict. Inst.* was still unpublished then, as Mueller wrote "I am sorry that the years transactions of our scientif. Societies are not yet fully printed, but I have given orders that a copy of the phil [a few obscured letters] transact. shall be transmitted to you, and will send reprints of the bot. articles of the Victorian Institute; both societies are now united .....". In addition, Mueller's words "will send" instead of "am sending" indicate a future intent and suggest that no preprints or reprints were yet available.

In *The Argus*, Melbourne, 14 Septembcr 1855, p. 5, there is a statement that "The transactions and proceedings of the Victorian Insitute for the Advancement of Science has been published by Mr. George Robertson, and shows that this society, like the Philosophical, has not been idle." An account of the transactions follows the statement and shows clearly that the publication referred to is that of the Victorian Institute. The transactions were therefore published before, but probably only 1-few days before, 14 September, as *The Argus* was a daily newspaper and normally would not delay long in its reporting. This conclusion is supported by *The Age*, Melbourne, another daily newspaper. On 15 September 1855, p. 5, *The Age* reported "The Victorian Institute. — The transactions and proceedings of this body, for the sessions 1854–55 have been published in a collective form. . . .". The report mentions contents and contributors, and thereby leaves no doubt that it refers to item A.

A publication date very closely preceding 14 September is also inferred by *The Illustrated Melbourne Family News* 1(4):35–36, dated 22 September 1855, where a review of *"Transactions and Proceedings of the Victorian Institute for the Advancement of Science, for the Sessions 1854-55"* is given. The *News* had apparently appeared weekly since its first number dated 1 September* and it is most likely that the transactions reached

Australian Builder & Land Advertiser contains advance advertisements for *Illust. Melb. Fam. News* notifying that No. 1 will appear on 1 September; I have seen No. 2 dated 8 September and No. 4 dated 22 September; No. 3 presumably appeared dated 15 September.

Table 1. Summary of all published *Transactions* of the three organisations which preceded the Royal Society of Victoria.

Item	Publication	Volume	Number or Part	Pages	Includes transactions for	Dates of Publication		
						Definite		Probable
						After	Before	
A	Trans. Vict. Inst.	Unnumbered	Unnumbered	1–167	June 1854-June 1855	7 June 1955	14 Sept. 1855	Apparently after 8 Sept.; possibly on 10 Sept.
B	Trans. Philos. Soc. Vict.	1	No. 1	1–33	Aug. & Sept. 1854	18 Sept. 1854	22 Nov. 1854	Probably before the end of Sept.; almost certainly before 8 Nov.
C	,, ,,	1 Complete		1–265 (1–33 repeat 1–33 of item B)	Aug. 1854 to July 1855	6 Sept. 1855	13 Sept. 1855	Apparently on 10 Sept.; believed to precede item A
D	Trans. Philos. Inst. Vict.				Aug. to Dec. 1855	Publication suggested but not effected		
E	,, ,,	1		1–158	Aug. 1855 to Dec. 1856	8 May 1857	3 June 1857	Apparently distributed 3 June
F	,, ,,	2	Pt 1	1–92	Jan to Aug. 1857	23 Sept. 1857	30 Sept. 1857	Apparently distributed 30 Sept.
G	,, ,,	2	Pt 2	93–176 (excluding pp. 131–134)*	Sept. to Dec. 1857	5 May 1858	26 May 1858	Apparently distributed 26 May
H	,, ,,	3		1–120	Jan. to Dec. 1858	23 June 1859	13 July 1859	Apparently distributed 13 July
I	,, ,,	4	Pt 1	1–98	Jan. to Aug. 1859	30 Nov. 1859	21 Dec. 1859	Apparently distributed 21 Dec.
J	,, ,,	4	Pt 2	99–210	Sep. to Dec. 1859	4 June 1860	25 June 1860	Apparently distributed 25 June

*pp. 131–134 were expunged from the volume. See p. 13 of Pescott, R.T.M., The Royal Society of Victoria from then 1854, to now, 1959. *Proc. Roy. Soc. Vict.* 73:1-40 (1961).

that periodical after their issue of 8 September and too late for the deadline for copy for the 15 September issue. If the transactions had been received long-prior to 15 September it is unlikely that the review of them would have been held over until the fourth number of 22 September, particularly as the review commences "The valuable volume before us . . ." and is most eulogistic of both the publication and the Institute.

Available evidence, although inconclusive, tends to indicate that distribution of this volume postdates that of the complete volume one (item C) of *Trans. Philos. Soc. Vict.* See under "Discussion".

B. Transactions of the Philosophical Society of Victoria, vol. 1, no. 1.

There are apparently few copies of this number surviving today. Its existence seems to have been overlooked previously but is indicated in the proceedings of the meeting of 10 July 1855 (PM1, xxv) where "The Honorary Secretary . . . intimated . . . that the Linnaean Society, of London, to which a copy of the first number of the Philosophical Society's transactions had been sent, acknowledged the receipt of same . . .". Verification is provided in the "Catalogue of the Library of the Linnean Society" (S1) where "Victoria:- Transactions of the Philosophical Society. Vol. 1. No. 1. *Melbourne*, 1854. 8 vo." is listed with Dr. F. Mueller as the donor. I have examined an original copy of this number owned by T. Darragh, Melbourne. It has a heavy paper cover which is clearly marked as Vol. 1. No. 1. and as the *Transactions* "for the months of August and September, 1854". Contents include pages 1–33 of transactions, set exactly as found in complete volumes (item C, see below) but with the reverse of page 33 left blank. Proceedings covering the meetings of 12 August and 10 and 18 September 1854, are also included, so that publication of this number must have been after 18 September 1854.

An estimate from James J. Blundell & Co. for the publication of the Transactions "to be published this month" was approved by Council on 5 September 1854 (CM1). From this, and from the speed of publication in the era concerned, it is probable that the number appeared before the end of September. It was almost certainly published by 8 November, as it was then resolved by Council (CM1) that "members taking twenty copies of the Transactions of the Society and upwards should obtain the same at cost price." On 22 November 1854 (CM1) bills passed for payment by Council included one to Blundell & Co. for "Publication of Transactions," showing that Vol. 1. No. 1. must have been published by that date.

The back cover of the original copy of Vol. 1. No. 1. bears a note that "No. 2. will be published on the 1st of January, 1855." I can find no evidence of a No. 2. ever appearing.

C. Transactions of the Philosophical Society of Victoria, vol. 1 complete.

In the Melbourne daily newspaper *The Melbourne Morning Herald*, for 20 April 1855, p. 2. there is a detailed advertisement by James J. Blundell & Co., the publishers, which reads "Transactions of the Philosophical Society of Victoria, for the year ending in July, 1855, will be published in four numbers, making one volume . . . Persons desirous of becoming regular subscribers . . . are requested to send in their names . . . on or before the 1st of June, 1855 . . ." Of the papers listed for inclusion three had already been published previously in the vol. 1, no. 1. of 1854 (item B above) and would therefore be reprinted in the proposed new, four-part volume.

The Blundell advertisement continued to be published daily in the same newspaper until about mid-May. It indicates a clear intention as at April/May 1855 to publish volume one of the *Transactions* in four separate numbers. However, I have found no evidence of publication of this volume in parts after this date, but only of publication of the whole volume complete in one issue.

An original copy of the complete volume of Transactions is in the library of the Royal Society of Victoria. It has the original stiff paper (or light card) cover intact, and this is clearly printed "Vol. 1", without any number, and "for the past year, ending in July, 1855." An introductory note, dated September 1855, states that the volume contains papers read from the Society's ". . . inauguration in August, 1854, to its amalgamation with the Victorian Institute . . .". The included transactions consist of pp. 1–265, pages

1–33 being an exact repeat of those pages in Vol. 1. No. 1 (1854), while p. 34 occupies the reverse of p. 33 and subsequent pages follow on. This issue is therefore a complete volume which reprints the transactions and proceedings of No. 1 (1854) and also adds those from subsequent meetings up to July 1855.

On 10 May 1855, while the Blundell advertisement cited above was still running, *The Melbourne Morning Herald* (p. 6) also published a detailed account of the meeting of "The Melbourne Philosophical Society" held on 8 May. From the account it is obvious that the meeting was that of the Philosophical Society of Victoria. At the meeting the secretary, Mr. Wekey, was queried about the publication of the society's transactions. He replied ". . . that several of the papers are already in type, but that they would not be printed off before the first of June next, being the time up to which subscribers' names will be received . . ." This reply confirms the imminence of publication indicated by the advertisement but makes no mention of publication in parts.

In *The Argus*, for 7 August 1855, p. 7, James J. Blundell & Co. announced that "The First Volume of "Transactions of the Philosophical Society" will leave the press in a few days. It will contain, the papers and proceedings of the Society for the year ending July, 1855 . . . Subscribers' names will be received till . . . the 15th inst., by the publishers . . ." The date for the receipt of subscriptions therefore had been extended beyond the date given in the original Blundell advertisement and the complete Vol. 1. would not have been published until after subscriptions closed on 15 August 1855. The paragraphs below show that publication was delayed until September.

On 6 September 1855 (CM2) "A letter from L. Becker Esq. was read . . . requesting that his two papers on "viviparous" fishes to be read at the next monthly meeting of the Philosophical Institute, be printed in the first volume of the Transactions of the Philosophical Society . . . [Council decided that] as the paper had not been read as yet, it could not be published in the forthcoming volume of the Transactions of the Philosophical Society." The complete Vol. 1. was therefore not yet published by 6 September 1855 but was apparently very close to being published, thus prompting Becker's request. Although his papers were read at a monthly meeting of the Philosophical Institute on the following day (PM2, xiv) their publication was still held over, thus reinforcing the above suggestion that publication of the complete volume was very soon after 6 September 1855.

The *Australian Builder and Land Advertiser*, No. 7, 13 September 1855, p. 57, states that "When about going to press we received a volume of the first published *Transactions of the Philosophical Society*, being a series of papers contributed by its members. . . .". Although a list of contents is not given, the nature of the comments which follow this statement indicates that the volume referred to is the complete volume one. As the previous issue of *Aust. Builder & Land Advert.*, No. 6, is dated 6 September, that periodical must have received its copy of the transactions between 6 and 13 September 1855, and probably only one or two days before the thirteenth.

The published minutes (PM2, xvi) of the general meeting of the Philosophical Institute for 28 November 1855 show that copies of *Trans. Philos. Soc.* had been widely circulated prior to that date. The volume number is not specified in the minutes but it is obvious from the timing and from reference to the transactions not having been published at the cost of the Philosophical Society (see footnote*) that the issue concerned is the complete volume one.

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*Although publication and distribution was effected in September 1855 additional copies continued to be bound and distributed well into 1856. Both the delays prior to September 1855 and the drawn-out completion period were due to financial difficulties. This is indicated by the first report of the Council of the Philosophical Institute which states (PM2, xxi) that "At the amalgamation of the two societies . . . all the available funds of the Philosophical Society had been expended in the publication of their Transactions for 1854, and it was therefore attempted, by a private arrangement, . . . to publish Transactions [of the Philosophical Society] for 1855." Mr. Wekey, a secretary of the Philosophical Society had undertaken "the responsibility of publishing them by private subscription" (see newspaper entries by J. J. Blundell & Co. above) but had "incurred a debt" (PM2, xvi) which the Philosophical Institute adopted at its meeting on 28 November 1855 (l.c.). The minutes of council meetings of the Philosophical Institute for 29 March and 2 April 1856 record correspondence between Mr. Wekey and the Institute concerning the reprinting of portions out of print and the binding of further copies. Council minutes of 7 May 1856 report the receipt of 134 copies from the binders and those of 7 June 1856 report the tabling of a memorandum showing the distribution of eleven copies.

Available evidence, although inconclusive, tends to indicate that this volume was distributed prior to the *Trans. Vict. Inst.* (item A). See under "Discussion".

D. Transactions of the Philosophical Institute of Victoria. Aug.-Dec. 1855

On 19 March 1856 (PM2, xxiii) it was moved "That . . . it is desirable that the Transactions for the period ending December 31st, 1855, be printed and published as soon as possible." This would refer only to the Transactions of the amalgamated body from August to December 1855, those of the two original organisations covering the first seven months of the year having already been published. I have found no evidence of this motion having been effected. To the contrary, on 10 September 1856 (CM2) at a special Council meeting called to consider "taking immediate measures for the publication of the Transactions" the secretary was "instructed to collect the papers which have been read before the Philosophical Institute since the amalgamation of the two Societies . . .". It therefore appears that no transactions of the Philosophical Institute had been published prior to 10 September 1856. Subsequent minutes (CM2) for 7 October, 14 October, 13 November 1856 and 6 January, 30 January 1857 indicate the steps taken in collecting and processing the papers until on 8 May 1857 a proof copy was presented to Council for instructions (see item E).

E. Transactions of the Philosophical Institute of Victoria, vol. 1.

On 6 May 1857 (PM3, xxxii) "The Honorary Secretary intimated that the "Transactions" of the Institute, for 1856, were printed, and that he only waited for final instructions from the Council to publish the same, in order that copies might be distributed to the members." On 8 May 1857 (CM2) the secretary submitted to Council "a proof copy of the "Transactions" and . . . [obtained] . . . final Instructions for Publication." On 3 June 1857 (PM3, xxxv) the secretary ". . . intimated that the "Transactions" of the Institute for 1856 had been published, and that copies were upon the table for distribution to . . . members . . .". Although these quotations refer to transactions "for 1856" the publication concerned also included transactions from August to December 1855. (See item D.)

F-J. Transactions of the Philosophical Institute of Victoria, vols. 2-4.

All information has been obtained from original copies with original covers held by either the Royal Society of Victoria or the National Museum of Victoria. Dates of publication determined from:

F. 30 September 1857 (PM3, xliii) "The Secretary announced the publication of Part Ist, of Volume II., of the "Transactions of the Institute", . . .". The last page of this part is dated 23 September 1857.

G. 26 May 1858 (PM4, viii) "The Secretary announced the publication of Part II., Vol. II., of the Transactions of the Institute for 1857, and the members present were supplied with copies of the same." The previous ordinary meeting was on 5 May, and as no announcement was made then Part II was apparently not published by that date.

H. 13 July 1859 (PM5, xvi) "The Secretary laid upon the table the third volume of the "Transactions of the Institute for 1859" [1859 is an error], and accounted for the delay in the publication of the same . . .". The previous meeting was 23 June 1859.

I. 21 Dec. 1859 (PM5, xxxiv) "The Secretary intimated that Part 1., Vol. IV., for 1859, was ready for distribution among the members present." The previous meeting was 30 November 1859.

J. 25 June 1860 (PM6, xi) "Dr. Macadam intimated that Part II. of Vol. IV was ready for distribution among the members." The previous meeting was 4 June 1860.

DISCUSSION

Evidence presented under items A and C shows that these two publications appeared within a few days of each other, or perhaps even on the same day. A quote from *The Herald*, Melbourne, for 10 September 1855, given and discussed below, states that one of the two volumes (which one is uncertain) was to be published that day. The present author's opinion is that the one to be published was that of *Trans. Philos. Soc. Vict.*, vol. 1 complete (item C), and that this preceded the appearance of item A, *Trans. Vict. Inst.* The former volume was reviewed on 13 September, the latter not until 14, 15 and 22 September, the first three reviews mentioned all being in daily newspapers which normally reported scientific events swiftly. In addition *The Argus* report of 14 September which announced publication of item A, q.v., perhaps infers that item C had appeared previously. However, the report (PM2, xxi, quoted under item A) which contrastingly infers that the Victorian Institute had already published its transactions by June/July 1855 is puzzling. If the inference is correct then the Institute must have delayed the sending of copies for review for about three months. Such a delay is unlikely as the newspapers were generous in their reporting of Institute activities and thereby provided good publicity. Certainly Mueller's letter (see under item A) clearly shows that *Trans. Vict. Inst.* was unpublished at 28 June 1855.

It should be noted that the uncertainty over priority of publication just discussed does not affect pages 1–33 of volume one of *Trans. Philos. Soc. Vict.* but only subsequent pages. Pages 1–33 were initially published in 1854 (item B).

The ambiguous announcement in *The Herald* (10 September 1855, p. 6) referred to above states "Proceedings of the Philosophical Institute. — We are glad . . . to announce that this volume, which has been some time in preparation, will be published to-day. . . ." No details of contents are given and therefore it is not possible to be certain which publication the announcement refers to. Although the Philosophical Institute is cited the date precludes the publication from being one produced by that amalgamated body. Instead, when considered in relation to other dated evidence given under item C (and bearing in mind that 8th and 9th September were a Saturday and Sunday) the date of *The Herald* announcement and the word "Philosophical" suggests that the work to be published that day was volume one (complete) of the transactions of the earlier Philosophical Society. This suggestion is reinforced by the allusion to the work having been "some time in preparation", a statement consistent with the delay documented by earlier extracts quoted under item C. The alternative suggestion that the work was the transactions of the *Victorian Institute* (item A) gains some credence when the words of the newspaper announcement are compared with those of an introductory, full-page notice titled "Advertisement" published at the commencement of the *Victorian Institute* transactions. Both the announcement and the advertisement refer, in respective order but in different words, to the varied nature of the papers, the expertness of their authors, the contribution of the papers towards furtherance of Victorian development, the popular style of writing and the hope of sales to the general public. *The Herald* announcement appears to be simply a rephrased copy of the advertisement published with the transactions themselves.

ACKNOWLEDGEMENTS

Acknowledgement is extended to the Royal Society of Victoria, the National Museum of Victoria and the State Library of Victoria for access to unpublished minutes (RSV), to original copies of *Transactions* (RSV and NMV) and to newspapers and journals (SLV). Dr Garran was particularly helpful at the library of the Royal Society and Mr T. Darragh, National Museum, located several obscure references and provided his own copy of item B for perusal.

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CM1 Minutes of Council Meetings of the Philosophical Society of Victoria (Unpublished. Held by the Royal Society of Victoria).

CM2 Minutes of Council Meetings of the Philosophical Institute of Victoria (Unpublished. Held by the Royal Society of Victoria).
PM *Trans. Vict. Inst.* Proceedings.
PM1 *Trans. Philos. Soc. Vict.* Volume 1. Proceedings.
PM2 *Trans. Philos. Inst. Vict.* Volume 1. Proceedings.
PM3 *Trans. Philos. Inst. Vict.* Volume 2. Proceedings.
PM4 *Trans. Philos. Inst. Vict.* Volume 3. Proceedings.
PM5 *Trans. Philos. Inst. Vict.* Volume 4. Proceedings.
PM6 *Trans. Roy. Soc. Vict.* Volume 5. Proceedings.
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VEGETATION OF THE WESTERN PORT CATCHMENT

by

A. M. Opie, P. K. Gullan, S. C. van Berkel and H. van Rees*

ABSTRACT

The catchment of Western Port, Victoria, was surveyed between January 1980 and September 1981, using a floristics-based, quadrat-sampling technique. The data from the 656 quadrat sites of this survey plus 362 quadrats from surveys carried out by others (between 1972 and 1979) were analysed using a computer-based, numerical sorting and classification procedure to determine the major, floristic vegetation types of the area. These were then arranged, hierarchically, into 19 floristic *communities*, each of which contained one or more distinct floristic *sub-communities*.

Communities defined in this paper range from wet mountain forests and sclerophyll woodlands in the north-east of the catchment, through open grassy woodlands and heathlands in the central regions, to sclerophyll woodlands, heathlands, swamps and grasslands near the coast.

INTRODUCTION

This paper presents the results of surveys of the vegetation of the Western Port catchment, Victoria. Its purpose is to define the major floristic vegetation types of the study area and give an indication of their distribution and environmental ranges. The results incorporate data from 656 quadrat sites examined in 1980–81 by a team from the National Herbarium of Victoria and from 362 quadrats surveyed by others between 1972 and 1979.

THE STUDY AREA

The study area is defined as the Western Port catchment plus the southern portion of Phillip Island (Figs 1 and 2). The major streams flowing into Western Port are, from west to east, Cardinia Creek, Toomuc Creek, and the Bunyip, Tarago, Lang Lang and Bass Rivers.

The catchment is approximately 3,300 square km in area and ranges in altitude from sea level to 898 m at Spion Kopje (Fig. 3). Median annual rainfall ranges from below 800 mm on French and Phillip Islands to above 1400 mm in the north east (Fig. 4). Most of the native vegetation in the catchment is on crown land controlled by the Department of Crown Lands and Survey, the Victorian Forests Commission or the Fisheries and Wildlife Division of the Victorian Ministry for Conservation.† The areas devoid of native

Fig. 1. Location of the study area in Victoria. The stippled area represents the Western Port catchment.

*National Herbarium of Victoria, Royal Botanic Gardens, South Yarra, Victoria 3141.

†Due to departmental amalgamations on 1 November 1983, this crown land is now controlled by the Department of Conservation, Forests and Lands.

Muelleria 5(5): 289-346 (1984).

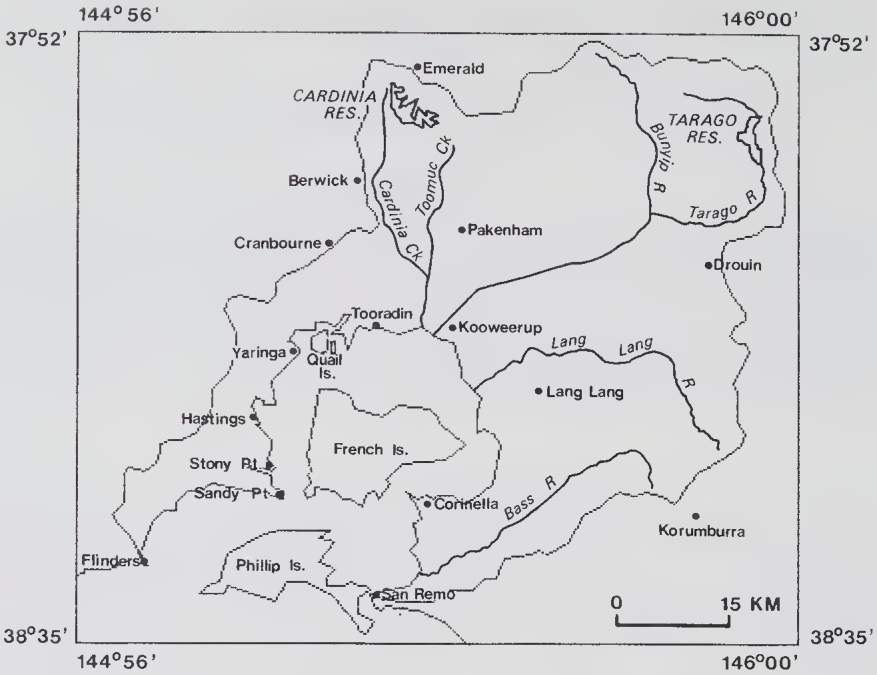

Fig. 2. The boundary of the study area and the major islands, towns, reservoirs and rivers within it. The base map used in this figure (excluding the rivers and place names) is computer-generated and schematic only.

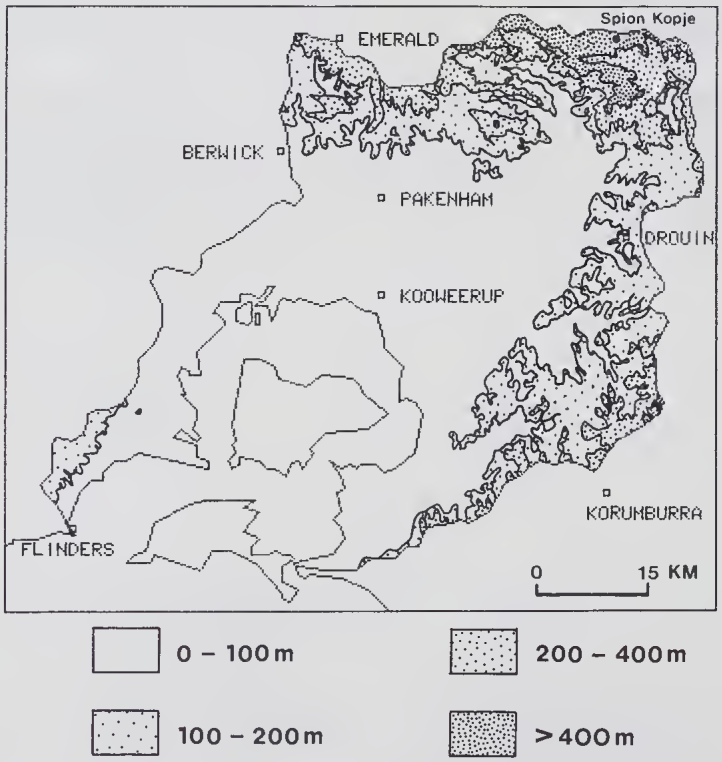

Fig. 3. Topography of the study area. Different density stippling represents different altitude ranges.

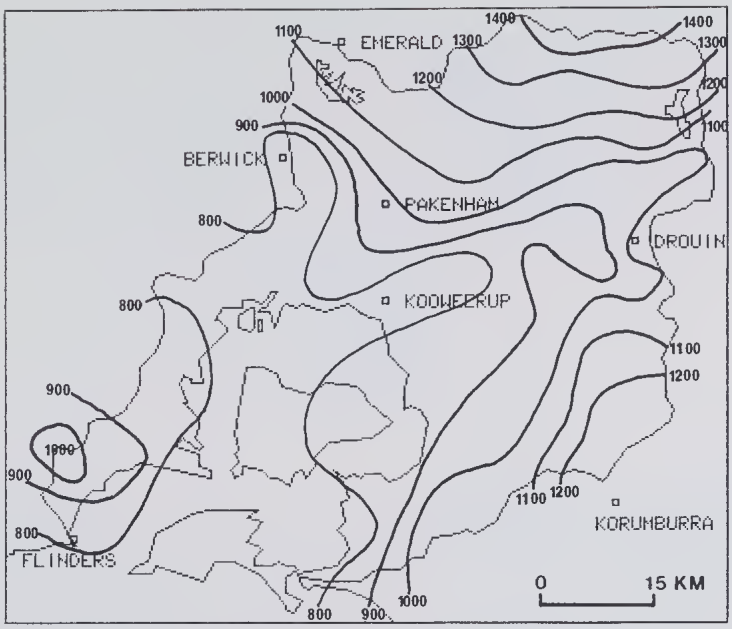

Fig. 4. Median annual rainfall (in mm) of the study area, after Shapiro (1975).

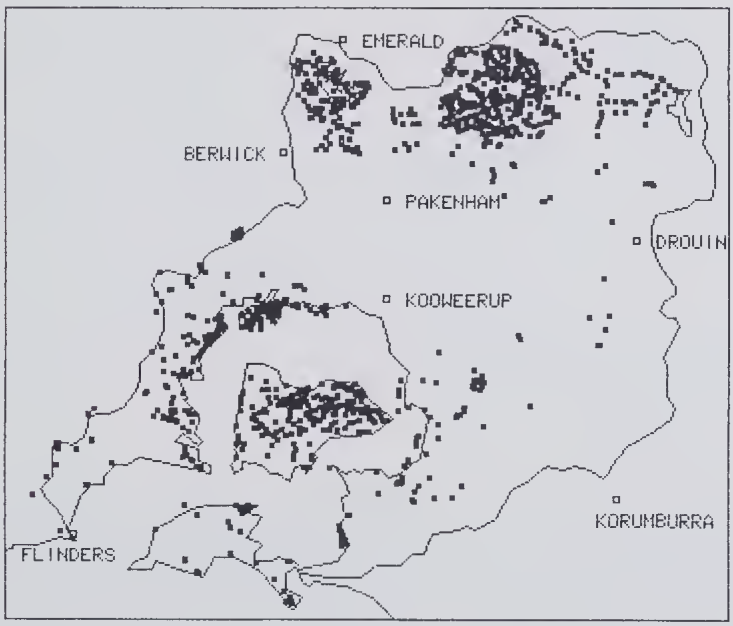

Fig. 5. Localities of all quadrat sites in the catchment.

vegetation are predominately privately owned and utilised for agriculture. The distribution of sample sites (quadrats) throughout the study area (Fig. 5) indicates the density and distribution of the existing native vegetation in the catchment. The most densely vegetated areas are found in the north of the catchment in the Black Snake and Blue Ranges and south of Emerald, and on French and Phillip Islands. Remnant areas of native vegetation occur throughout the Mornington Peninsula in the west of the catchment. In the hills to the east of the study area the forests have been cleared completely. In the central lowlands the Koo-Wee-Rup Swamp has been drained and converted to pasture land so that almost no native plant species remain except on a few roadside verges.

THE SURVEY

Method

Field Work

The sampling procedure for the 1980–81 survey utilised the one kilometre square grid of the Australian National Mapping System. Within each square substantially covered by native vegetation two quadrats (or only one if the square was less than half covered by native vegetation) were chosen so that they represented a range of visibly different habitats (e.g. river, swamp, hillside, ridge). Each site sampled constituted a single uniform stand of vegetation and covered an area of approximately 1000 square metres. Every vascular plant species within a quadrat was identified and assigned a cover/abundance value (Gullan 1978) corresponding to a visual estimate of its performance in that quadrat. A total of 656 quadrats was sampled in this way.

All the suitable botanical information available for the study area from other sources was also collated. These additional data sources were Gullan *et al.* (1979), Gullan (1978), Wellington *et al.* (1977), Grant (1974) and Calder (1972). The basic method of floristic data collection was the same for these previous surveys as the method described above with the exception of the area of the quadrats used. This was either 25, 90 or 1000 square metres. Data from these sources comprised an additional 362 quadrats.

Plant Identification

For the 1980–81 survey all plants which could not be identified in the field were collected, labelled and taken to the National Herbarium for closer examination and comparison with the Herbarium's reference collection. This procedure allowed for the identification, to species level, of all but a few plants collected. Nevertheless a number of qualifications must be made concerning the nomenclature used in this paper. As far as possible all nomenclature follows that of Willis (1970, 1973) with amendments by Todd (1979, 1981). However, due to the difficulty in distinguishing between certain closely related groups of species, particularly those for which vegetative parts only could be found, some names should be taken to mean one of two or more species. For example:

Amyema pendulum, A. miquelii — all have been recorded as *A. pendulum* except where flowering material indicated otherwise.

Casuarina paludosa, C. pusilla — no distinction was made between these closely related species on the mainland and all were recorded as *C. paludosa*. On French Island two distinct taxa were apparent. A glabrous form was recorded as *C. pusilla* and a pubescent form as *C. paludosa*.

Caustis pentandra, C. restiacea — a few definite specimens of *C. restiacea* have been collected but, as *C. pentandra* sometimes has fine culms and *C. restiacea* has not been recorded from the area previously, it is likely that *C. restiacea* is more abundant than is indicated by this survey.

Centaurium pulchellum, C. minus — distinction between these species is made difficult by the broad overlap in distinguishing characteristics. Absence of flowering material increases this difficulty. If there was any doubt the species was recorded as *C. pulchellum*.

Danthonia pilosa, D. racemosa — although most specimens were easily referable to one or other of these species, some intergradation was apparent.

Drosera auriculata, D. peltata — differentiation between these species was difficult in the absence of flowering material.

Eucalyptus dives, E. radiata — intergradation between these species made them sometimes difficult to distinguish.

Filmy ferns *(Hymenophyllum* spp., *Mecodium* spp. and *Polyphlebium venosum)* have a cryptic habit and some species may have been overlooked.

Hypolepis spp. — differentiation between the four species of this group was difficult and it is possible that the wrong name has been applied on occasions.

Juncus spp. — species of the section Genuini were identified where possible but some difficulties were encountered and all have been recorded as *Juncus* spp. for the purposes of this paper.

Lagenifera stipitata, L. gracilis — vegetative states are very similar. All have been recorded as *L. stipitata* except where reproductive material has indicated otherwise.

Lepidosperma filiforme, L. semiteres — although most specimens were easily referable to one or the other species some intergradation was apparent.

Leptospermum lanigerum, L. glabrescens — in some areas, particularly along rivers, differentiation between these two species was difficult and it is possible that, on some occasions, the wrong name has been applied.

Luzula campestris sp. agg. — no attempt has been made to distinguish between the species of this group described by Nordenskiold (1969) and Edgar (1975).

Poa australis sp. agg. — no attempt has been made to distinguish between the species of this group described by Vickery (1970).

Rubus fruticosus sp. agg. — no attempt has been made to distinguish between the members of this group described by Amor and Miles (1974).

Stipa hemipogon, S. semibarbata — although usually easy to distinguish, even in the field with a hand lens, mistakes may have been made or one species may have been overlooked at some sites.

Stipa pubescens — an unusual form of this species was encountered on French Island. Later taxonomic work may show this to be a new species.

Tmesipteris ovata, T. parva — due to the similarity of these species it is possible that on some occasions the wrong name has been applied.

Grant (1974) recorded *Leucopogon collinus* on French Island. However, this species is commonly restricted to the near-coastal heaths of Gippsland. Unfortunately no specimens could be located to verify the identification. For the purposes of this paper these records are assumed to refer to either *Leucopogon australis* or *Leucopogon parviflorus*.

Data Storage and Analysis

Information from each quadrat site (floristics, locality, altitude and sampling data) was stored permanently on magnetic disc. Analyses were in the form of a computer-based, numerical classification procedure coupled with a hand-sorting procedure of the type outlined in Gullan (1978). The final result of this analysis is a two-way table which holds all of the raw data in a sorted form. However, because most species occur in less than 10% of the quadrats and add little to the overall vegetation description, the two-way tables presented in this paper do not contain all the species

recorded in each quadrat. For a full explanation of the two-way tables see Gullan *et al.* (1981).

Terminology

The terminology associated with the vegetation classification follows that of Gullan *et al.* (1981). These terms are discussed briefly here.

Sub-Community

A sub-community is a group of quadrats which have a similar floristic composition.

Community

A community is a collection of one or more sub-communities which have floristic and environmental affinities. The community may represent a floristic continuum along which arbitrary divisions have been made to form sub-communities. It may represent a collection of sub-communities which are considered to be different temporal phases of the same vegetation or vegetation under different disturbance regimes (e.g. fire, grazing, clearing).

Character Species

A character species is one which occurs frequently and consistently in the quadrats of a sub-community and is useful as an indicator of that sub-community. For a fuller discussion of this term and its numerical calculation see Gullan *et al.* (1981).

Community Names

These are familiar and descriptive names (common names) applied to the communities and take into account common, although often imprecise, terminology (e.g. Wet Sclerophyll Forest). The naming system used here is described more fully in Gullan *et al.* (1981). Where appropriate the names of communities in this paper follow those of Gullan *et al.* (1981) and Forbes *et al.* (1982).

Limitations and Qualifications

Floristics

As each quadrat was sampled only once some annual and ephemeral species may have been missed at quadrat sites.

Distribution of Sub-communities

The distribution maps provided with the sub-community descriptions show sites where a sub-community has been positively recorded. They are not exhaustive maps of each sub-community.

Weeds

The mean weed composition of each sub-community has been determined in this paper. This is an indicator of weed invasion into native plant communities. It should not be interpreted as an indicator of the abundance of weeds in the entire study area.

RESULTS

The results of the survey and its analysis are presented in three different ways in order to provide easy access to any piece of information relevant to the aims of this paper.

Two-way Tables

The two-way tables (Tables 1–14) contain a succinct description of the floristic composition of the vegetation and are the most important source of information on floristic variation within and between different kinds of vegetation (see Gullan *et al.*, 1981).

Community Descriptions

Nineteen communities have been described for the Western Port catchment. One community, a woodland with a grassy understorey, has been severely reduced in area since European settlement. It is considered that no unaltered representatives of this community exist in the study area and that one or more sub-communities have become extinct since settlement. An entire community, which was represented by a vast swampland north of Koo-Wee-Rup, has become extinct since European settlement. Very little is known of its floristic composition.

Forty-three of the 1018 quadrats sampled in the survey did not fit into the vegetation classification and consequently have not been assigned to a community. These quadrats invariably represent sites that have been grossly disturbed in the past.

A brief description of each of the communities is given below.

WPC Community 1: Cool Temperate Rainforest (Fig. 6a).
(1 sub-community; 9 sites).

An open to closed-forest found in the wettest gullies in the north-east of the study area. This community occupies only narrow strips along water courses and the major tree, *Nothofagus cunninghamii*, is seldom greater than 15 m in height or 1 m in girth. This suggests that the study area provides only marginal habitat for Cool Temperate Rainforest.

WPC Community 2: Wet Sclerophyll Forest (Fig. 6b).
(5 sub-communities; 109 sites).

Tall open-forest mainly found on kraznozem soils in the hilly country of the north-east between 100 and 750 m. The major tree species is usually *Eucalyptus regnans* but *E. viminalis, E. obliqua* and *E. cypellocarpa* are also common. The understorey is usually characterised by tall, broad-leafed shrubs and tree ferns.

WPC Community 3: Riparian Forest (Fig. 6c).
(3 sub-communities; 57 sites).

An open-forest which borders, and in some cases extends into, the rivers and creeks of the foothills (between 50 m and 250 m) to the north and east of the Western Port catchment. This community is usually floristically rich and varied and often supports agricultural weeds. The principal tree species of Riparian Forest in the Western Port catchment is *E. ovata*.

WPC Community 4: Dry Sclerophyll Forest (Fig. 6d).
(1 sub-community; 11 sites).

An open-forest, scattered in the central part of the study area, on shallow, rocky soils of sloping ground between 100 m and 200 m. Trees are usually *E. obliqua, E. radiata* and *E. globoidea* (near its western limit). The understorey is usually very open and is dominated by grasses and herbs. Large boulders are a feature of the landscape.

WPC Community 5: Damp Sclerophyll Forest (Fig. 6e).
(9 sub-communities; 141 sites).

An open-forest to low open-forest found on loamy soils throughout the study area between 10 m and 500 m. The tree layer is varied and usually supports stringybarks *(E. obliqua, E. baxteri, E. sieberi)*, peppermints *(E. radiata)*, and gums *(E. cypellocarpa)*. The understorey varies in floristic composition and richness but is usually dominated by sclerophyllous shrubs, many of which are legumes, (e.g. *Acacia* spp., *Pultenaea* spp., *Spyridium parvifolium, Platylobium formosum)*, and almost invariably contains wire grass *(Tetrarrhena juncea)* and bracken *(Pteridium esculentum)*.

WPC Community 6: Wet Heathland (Fig. 6f).
(3 sub-communities; 29 sites).

A closed-heath to woodland found on seasonally waterlogged soils in the north of the study area between 50 m and 200 m. The vegetation supports a wide range of sedges, lilies and sclerophyllous shrubs; the latter are mostly representative of the

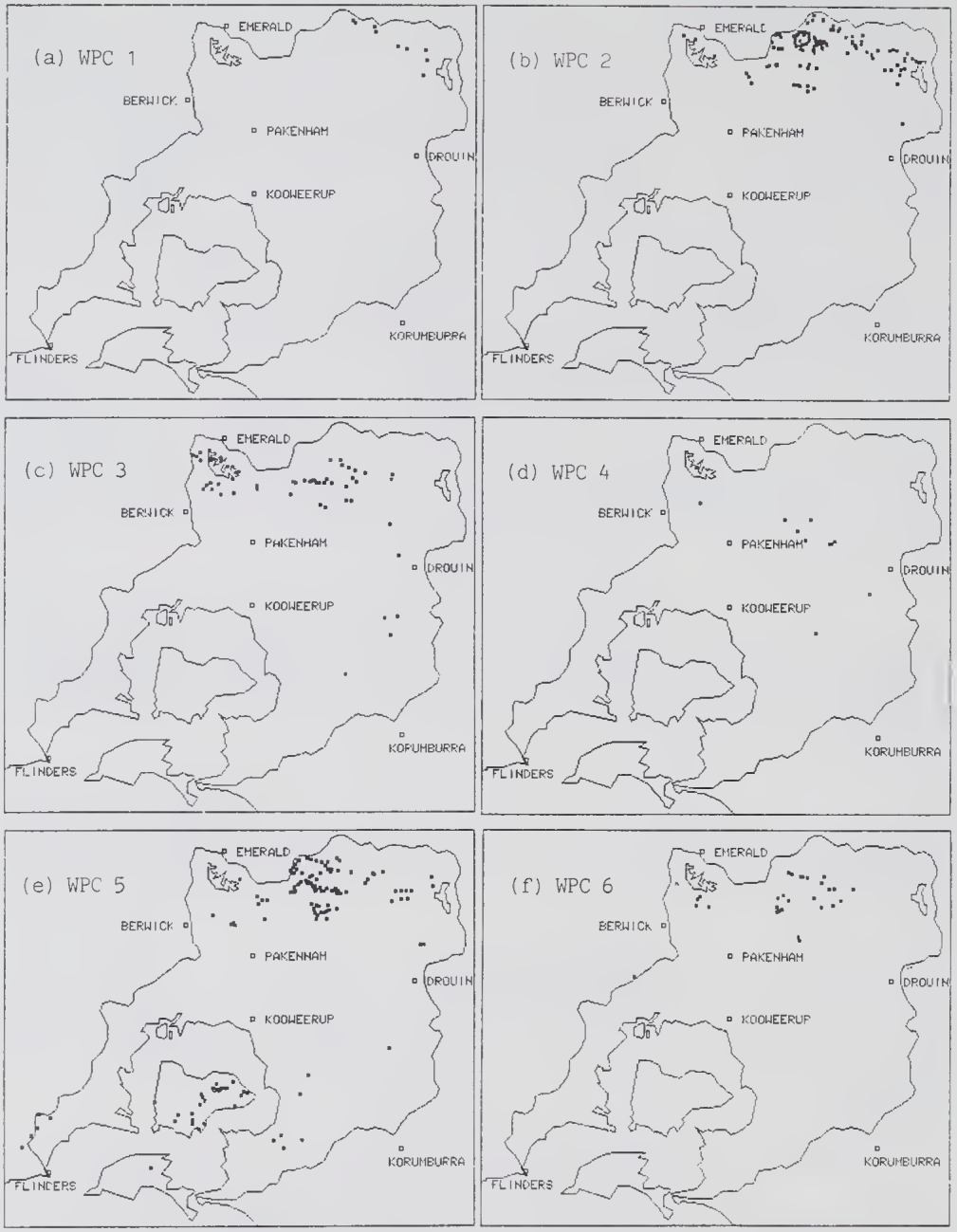

Fig. 6. Distribution maps for communities 1–6. Black squares represent quadrats. Open squares represent major towns.

Fig. 7. Distribution maps for Communities 7–13. Black squares represent quadrats. Open squares represent major towns.

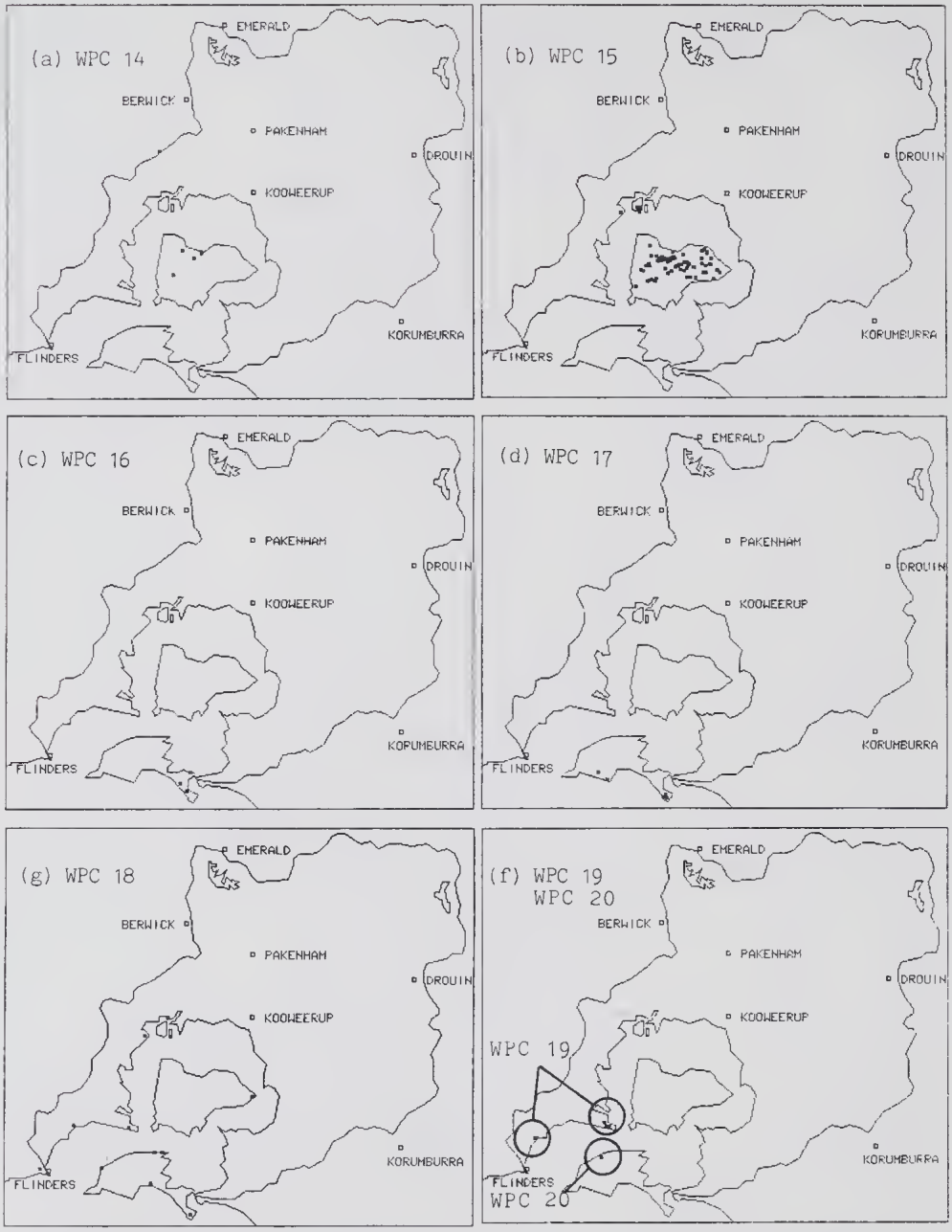

Fig. 8. Distribution maps for Communities 14–20. Black squares represent quadrats. Open squares represent major towns.

families Proteaceae, Epacridaceae and Myrtaceae. Trees are never common in the Wet Heathland but when present they are usually *E. cephalocarpa*.

WPC Community 7: Sclerophyll Woodland (Fig. 7a).
(5 sub-communities; 183 sites).

A woodland to low open-forest found on gravelly clays in the north-west and north-central parts of the study area between 40 m and 400 m. The trees are usually small with very short trunks. *(E. goniocalyx, E. cephalocarpa, E. radiata, E. dives, E. sieberi, E. obliqua)*. The understorey is floristically rich and is characterised by an abundance of grasses (particularly *Stipa muelleri* and/or *Themeda australis)*, tussock-forming sedges, *Banksia* spp. and *Hakea* spp.

WPC Community 8: *Leptospermum myrsinoides* Heathland (Fig. 7b).
(6 sub-communities; 201 sites)

A closed-heath to woodland found on podzols of near-coastal regions of Western Port and French Island between 5 m and 90 m. Trees are common but seldom dominant in this community with usually one chief species. To the north-east and west of Western Port *E. viminalis* is the main tree species, on French Island it is *E. obliqua* and to the east it is *E. radiata*. The understorey is dominated by *Leptospermum myrsinoides* and a range of smaller, sclerophyllous shrubs mainly of the families Myrtaceae, Proteaceae, Papilionaceae, Epacridaceae and Casuarinaceae.

WPC Community 9: Grassy Woodland (Fig. 7c).
(2 sub-communities; 60 sites).

An open-woodland to woodland occurring on clay soils, mainly on the western side of Western Port between 5 m and 35 m. This is one of the most floristically rich communities of the study area and also the most weedy. Most of the introduced species are grasses and herbs of pasture origin dispersed amongst the native grasses and herbs which naturally dominate the understorey.

WPC Community 10: Unnamed (Fig. 7d).
(1 sub-community; 6 sites).

An open-forest found on clay soils in the south of the study area between 15 m and 70 m. The tree, *E. pauciflora*, is normally associated with subalpine regions (e.g. Gullan *et al.*, 1981) and only occasionally occurs at lower altitudes. The understorey of Community 10 is principally that of a grassland which has been disturbed by grazing and fire.

WPC Community 12: Unnamed (Fig. 7e).
(1 sub-community; 4 sites).

A low woodland on poorly-drained, sandy soils on Quail Island and at Warneet, near sea level. The distinctive feature of this vegetation is the dense swards of the lilies *Lomandra longifolia* and *Dianella revoluta* which dominate the understorey beneath a canopy of *Eucalyptus viminalis*.

WPC Community 13: *Melaleuca ericifolia* Scrub (Fig. 7f).
(4 sub-communities; 61 sites).

An open-woodland to closed-scrub found on wet clay soils of coastal and near-coastal regions in the study area. The principal feature of this community is the dense stands of *M. ericifolia* which may form such a complete canopy as to exclude almost all understorey plants. The range of understorey species associated with this community is quite large as they tend to be those that are common in the vegetation immediately adjacent to the *M. ericifolia* thickets. Consequently, salt marsh, heathland, grassland and forest species are all components of *Melaleuca ericifolia* scrub.

WPC Community 14: Sedge Swampland (Fig. 8a).
(3 sub-communities; 6 sites).

An open or closed-sedgeland occuring on waterlogged soils or shallow ponds on French Island, Cranbourne and Lang Lang. This community is usually dominated by one or two species of sedge with an occasional emergent shrub.

WPC Community 15: Coastal Heathland (Fig. 8b).
(6 sub-communities; 83 sites).
A closed-heath or sedgefield found on sandy soils underlain by clay, at or close to sea level. It is contained almost entirely in Quail and French Islands. The community lacks a tree layer and is usually dominated by one or more species of shrub *(Leptospermum* spp., *Casuarina* spp., *Melaleuca squarrosa)* with an understorey of sedges. In some places, where the soil is periodically waterlogged, a range of tiny annuals cover the ground during late spring.

WPC Community 16: Primary Dune Scrub (Fig. 8c).
(1 sub-community; 3 sites).
A closed-scrub found on calcareous sand of primary dunes. Confined, in the study area, to the south-eastern coast of Phillip Island. This community has been subject to severe erosion due to human trampling and many areas have been stabilised by plantation of the introduced Marram Grass *(Ammophila arenaria).*

WPC Community 17: Coastal Tussock Grassland (Fig. 8d).
(1 sub-community; 5 sites).
A tussock grassland found on calcareous sands near the southern coast of Phillip Island. The dominant species of this community, *Poa poiformis*, was much more abundant in pre-European settlement times but its range has been considerably reduced by pasture improvement.

WPC Community 18: Coastal Tea-tree Scrub (Fig. 8e).
(2 sub-communities; 25 sites).
A woodland to closed-scrub found on calcareous sands on the coast of Phillip Island, French Island and south-west Western Port. The major feature of this community is *Leptospermum laevigatum* which completely dominates the vegetation in many places.

WPC Community 19: Coastal Banksia Woodland (Fig. 8f).
(1 sub-community; 6 sites).
A woodland found on calcareous sands on the coast between Crib Point and Flinders. This vegetation is often floristically depauperate and may support little more than its major species, *Banksia integrifolia, Eucalyptus viminalis, Pteridium esculentum* (often very high cover values due to frequent fires) and *Leucopogon parviflorus*. Coastal Banksia Woodland is probably much less common now than before European settlement. It may once have been co-extensive with Coastal Tea-tree Scrub with which it has floristic and environmental affinities.

WPC Community 20: Unnamed (Fig. 8f).
(1 sub-community; 2 sites).
A low open-forest found on calcareous sands of Phillip Island. The main feature of this community is the large, old stands of *Melaleuca lanceolata* (Moonah). The ground layer has been disturbed by human trampling and contains a large complement of introduced grasses and herbs.

Sub-community Summary Sheets

The following three sets of information have been amalgamated to produce a summary sheet for each of the 56 sub-communities. These summary sheets constitute the primary means of describing vegetation in this paper.

Sub-community Distribution Maps: The distribution of each sub-community throughout the study area is shown by means of a schematic map of the study area on which is marked the location of its constituent quadrats.

Character Species Tables: These tables summarise information from the two-way tables and present it in a different format. The tables contain the character species of each sub-community, listed in order of their frequency of occurrence, and the frequency and

mean cover/abundance of each species. In contrast to the two-way tables, in which the species are arranged to demonstrate the interrelationships between sub-communities, the character species tables have the species arranged to show their relative importance within an individual sub-community.

Sub-community Descriptions and Annotations: A simple description has been made for each sub-community which includes briefly summarised information on its distribution, environment, altitude, structure, floristic richness and weed composition.

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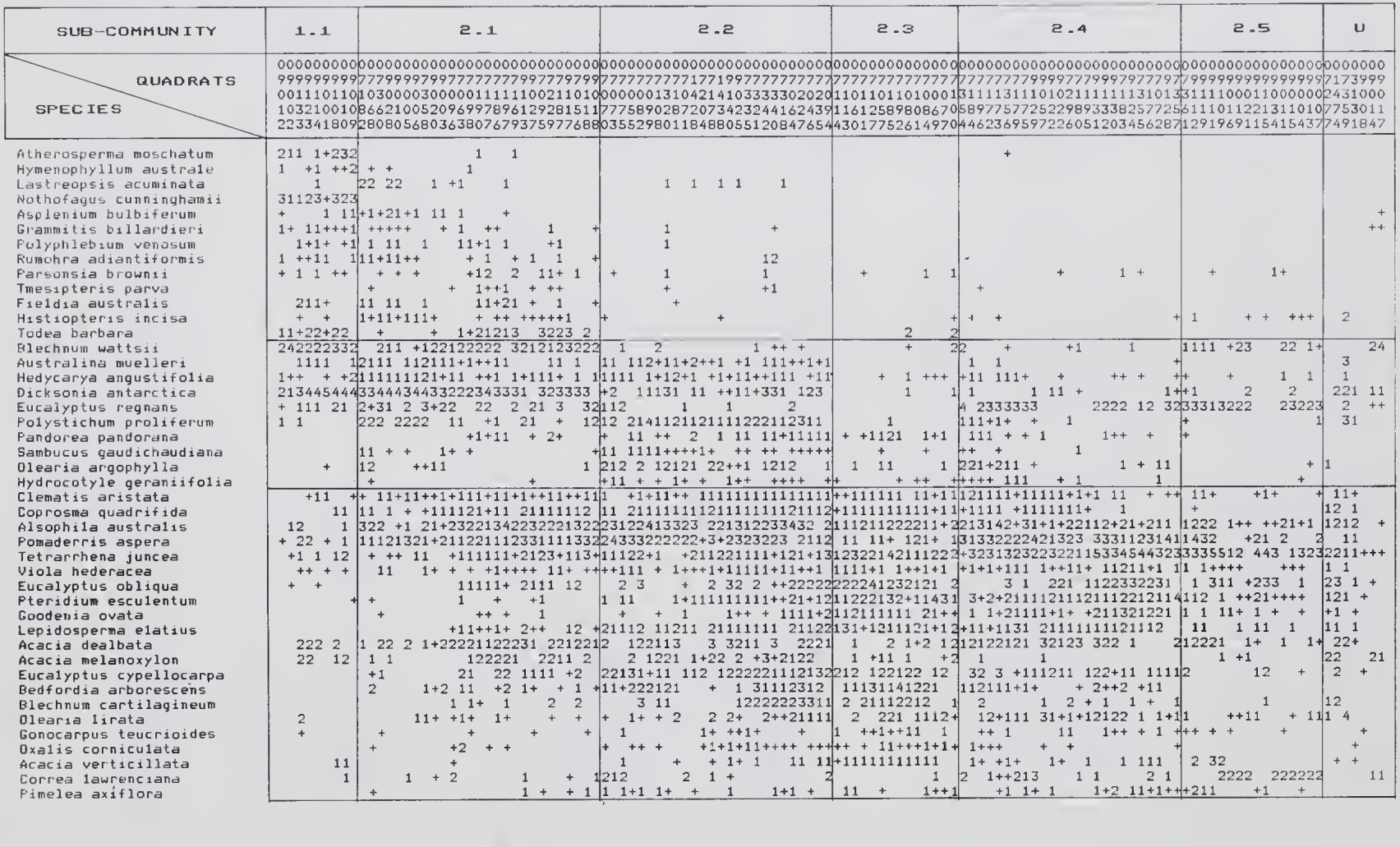
Table 1. Two-way table of Communities 1 and 2.



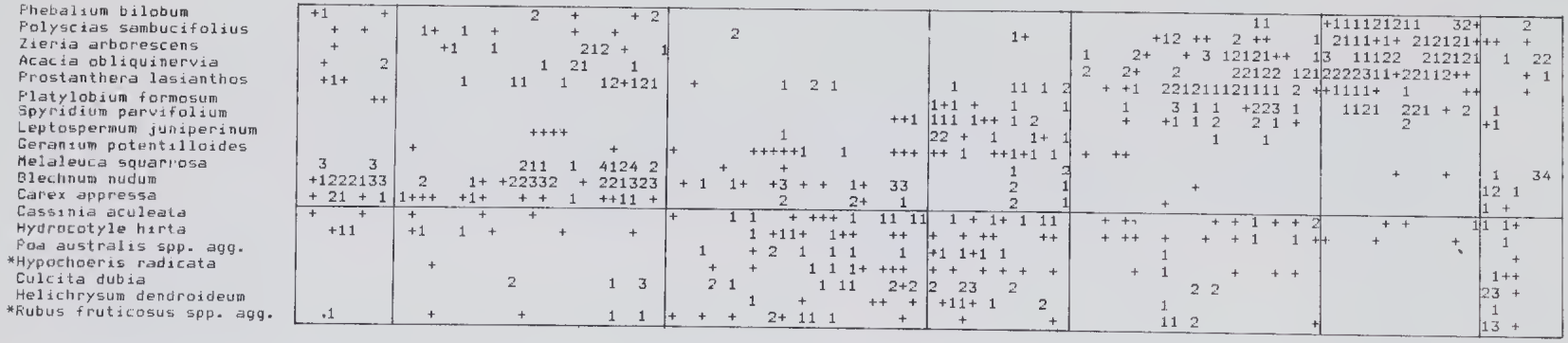
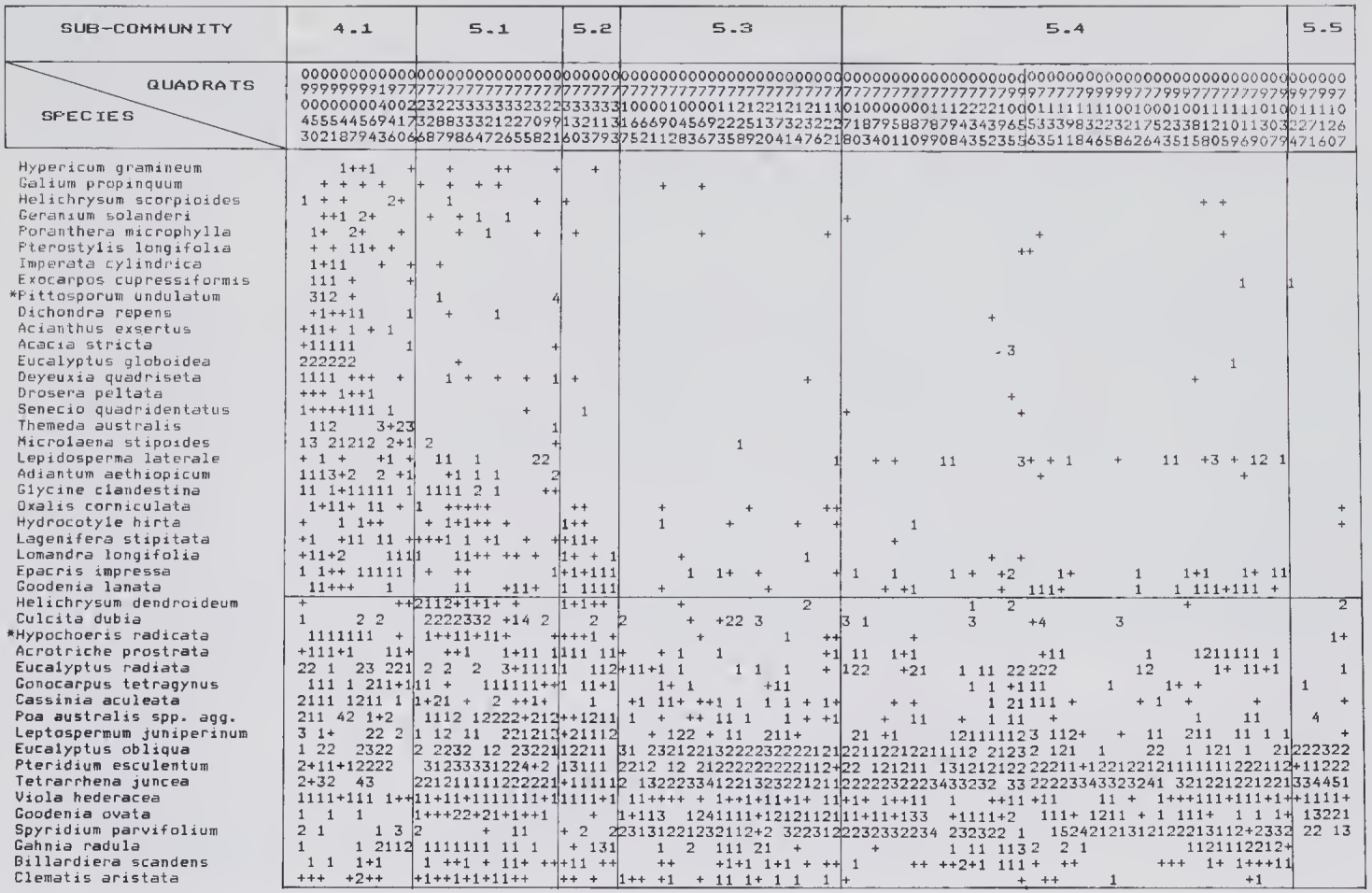
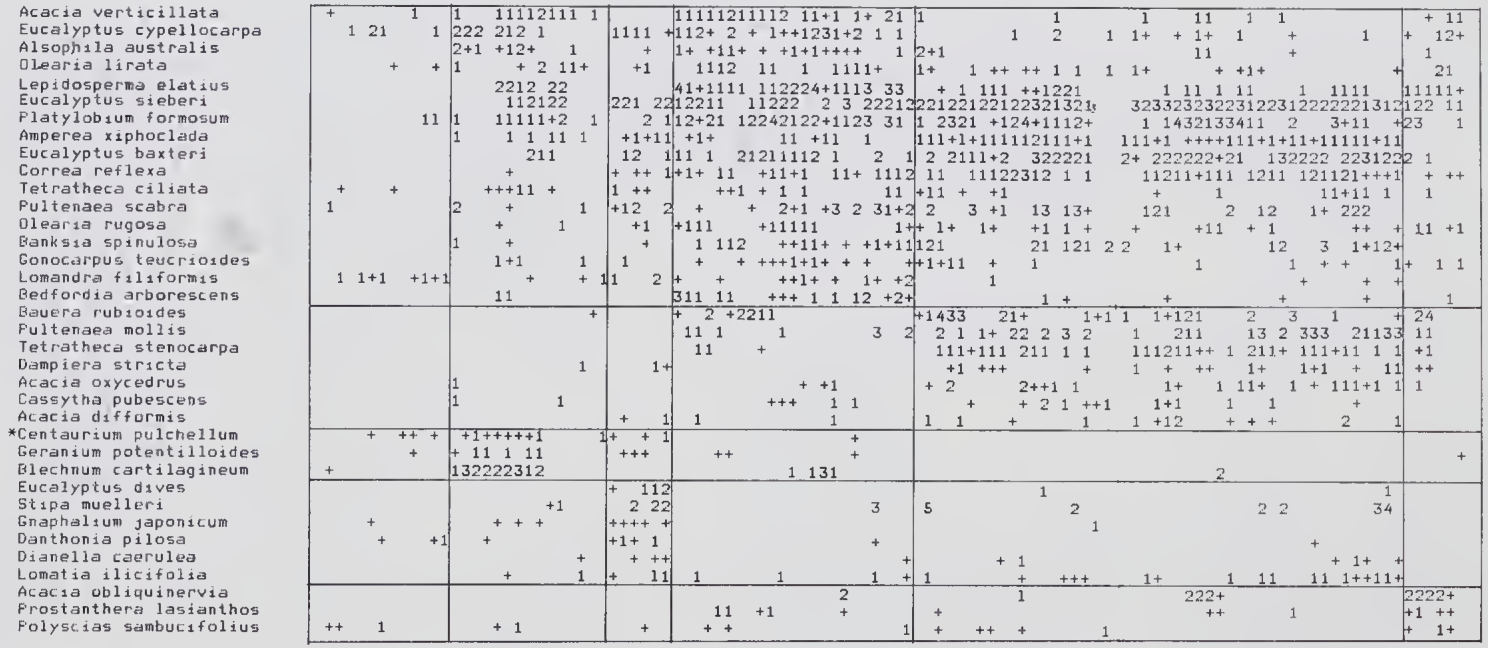

Phebalium bilobum
Polyscias sambucifolius
Zieria arborescens
Acacia obliquinervia
Prostanthera lasianthos
Platylobium formosum
Spyridium parvifolium
Leptospermum juniperinum
Geranium potentilloides
Melaleuca squarrosa
Blechnum nudum
Carex appressa
Cassinia aculeata
Hydrocotyle hirta
Poa australis spp. agg.
*Hypochoeris radicata
Culcita dubia
Helichrysum dendroideum
*Rubus fruticosus spp. agg.

Table 2. Two-way table of Community 3.

SUB-COMMUNITY	3.1	3.2	3.3
QUADRATS / SPECIES	000000000000000000000000	000000000000000000000000000000	0000000
	977777777779799777977777	999711117777117717777117777	7777779
	021112221230200121031331	000044440000440040000440022	2221110
	394352645653053303646339	866153954002540233135555431	1455655
	284281972607786664691124	202404124570958679242360798	3363873
Platylobium formosum	+ + + + +13 11	21	
Conocarpus teucrioides	+ 1 1 + + 1	+ 1 +	
Bauera rubioides	3 1 + + 21+ 2 +	11 +	
Todea barbara	2 3311 223 1		
Blechnum wattsii	11 2 2 1 12 + 222 1	2 1	
Gleichenia microphylla	434122 +1 1423 4122+ 1	3 1 +++	
Dicksonia antarctica	22121 ++ ++ 1 + 1+ 22 1	++ + + + + + 1	
Coprosma quadrifida	111 1 + 111111111	1 + + 11 1 + 111 +1	
Pomaderris aspera	+11 32 2 21112321	2 + 1 1 21 +221 13	
Clematis aristata	+ ++ + +1 ++11	1 1 11 + + 11 11 1	
Leptospermum juniperinum	1 12 232 122 1 + +2	2211+122+11 11 3+1 1 122 11 +	
Eucalyptus obliqua	+ 21+11 + 2+ 2++11	31122111 ++12211+ 1+21 11 + +	
Pteridium esculentum	2 + 221 1++ 11	12211+2+ 121121 +11 122221 1++ 1	
Goodenia ovata	+ 1++2+1 21 111 11	11+11+ 11111+ 2 11++3111 + 1	
Tetrarrhena juncea	11+1111111+3223111+ 12	242221112 121211111111111 1 + 2	
Blechnum minus	1121 1 1 21 11 11++211	+ 11 ++1 11 13++ 1 2+ 1	
Lepidosperma laterale	1121+2 12 3 13 22 +2	111121213122 12 22 2233 2	
Melaleuca squarrosa	3544322532322222 3344341	221 2 1 2222 2 23111	
Alsophila australis	1122++141+22 1++22211222	++1 +1 1 12 + 1+31 2+11+1++	
Poa tenera	+ 1 111121 2 12222112	22211 11112 2 +1+ 221 3223331	
Gahnia sieberiana	1 11+ 112 21 2 1111211 +	+ 1++1 21 21 + 2+ 1 11+1222211	
Blechnum nudum	23342223 111113132142 2	12 1+21221+111 411 21 22+2+1	
Carex appressa	1 2++23 1 +1 1+1212331+	+ ++1111 1+1 + 1 1+23 3222441	
Acacia melanoxylon	2212 31 11++ 21+321+2	+112 2 + 331 222 1121+22	
Eucalyptus ovata	1 112 12 1 2	122 +1+ 2 +1 ++ ++ + 2 2232222	
Acaena anserinifolia	+ 1 + + 1 11	+11 + +11+++ + +11+1112 1 1111111	
Acacia dealbata	1 2 12 2+ 2211	2 112+21 12 1 122211	
Oxalis corniculata	+ +1 1 +++11+	+1 ++11+ +++ + ++ + + +1+1 ++	
Conocarpus tetragynus	+ 1 +11 +1 ++ 1	+ 111++11 111 + 1 1 11 2++1	
Viola hederacea	111 + +++ 1 1+11+	+ 1++++1 +1++ + 1 +1 11+	
*Rubus fruticosus spp. agg.	+ 2 +1+ 1 1 21	12 1+121+ 1 2 +11121 21 1 ++1	
Acacia verticillata	+1 +11 + 1+ +1+	+11+++1111 +11+11 +1111 + +	
Olearia lirata	+ +1 +1 +1++111	+1+ ++1+ 1 + 1 + 2 +	
Eucalyptus cypellocarpa	+1 + 21+ 3 21121	2 2 2 11 2 1 2 2 2 2 2	
Cassinia aculeata	1 1 1	21111+21 1+ 1 ++ + 111 1 +	
Hydrocotyle hirta	1 +1 + 1 +	+11 ++++ 1++++ 1+ ++ +	
Poa australis spp. agg.	1 1 1	31 21+21 1311 1 3 + 111 1 1 +2	
*Hypochoeris radicata	+1 + ++ + +1	11 + 11 + 1 111 ++ + ++1	
Cirsium vulgare	1+ 1 3 2 2	1 222 22 22 + 11 21	
Helichrysum dendroideum	1 + 1+	2 1 1++11 111111112 12 1	
Spyridium parvifolium	1 + 1 1	1++1 121 + 2	
Cyperus lucidus	1	11 + 2 212322	
Rubus parvifolius	+ + 1 1	+1 11 + + 1 11111 1	
Scirpus inundatus	1 1 1 + + +	+ 11+ 1 1+11 111 ++	
Gratiola peruviana	+ ++ + + 1	1+ 21 + + 111 1	
Cynatrix pulchella	+	+ 1 ++ ++	
Hypolepis muelleri	+ +	11 11	
Lobelia alata	+ +1 + + 1	++ ++ 1+ 1 1+++	
Phragmites australis	+ 1	2 2 115	
Polygonum strigosum	1	+ 2111	
Juncus spp.	+ 1 +	+ ++1 +1 1++	
Geranium solanderi	1 1 +	1 + +11 +1	
Leptospermum lanigerum	+ 1 2	2 1 1 3224 4	
Lepidosperma elatius	121 + 111	1 12 2 1+	
Blechnum cartilagineum	11+ +2	2 + 2 211	
Polyscias sambucifolius	+ + + + 1	1 1 11 + 1 11 + +	
Prostanthera lasianthos	+ 12 1+ +12+ 1	1 1 1 1 2 1 + 1	
Eucalyptus viminalis	+ 1 1	2 12 1 2 3 2	

Table 3. Two-way table of Communities 4 and 5:5.1–5.5.




Acacia verticillata
Eucalyptus cypellocarpa
Alsophila australis
Olearia lirata
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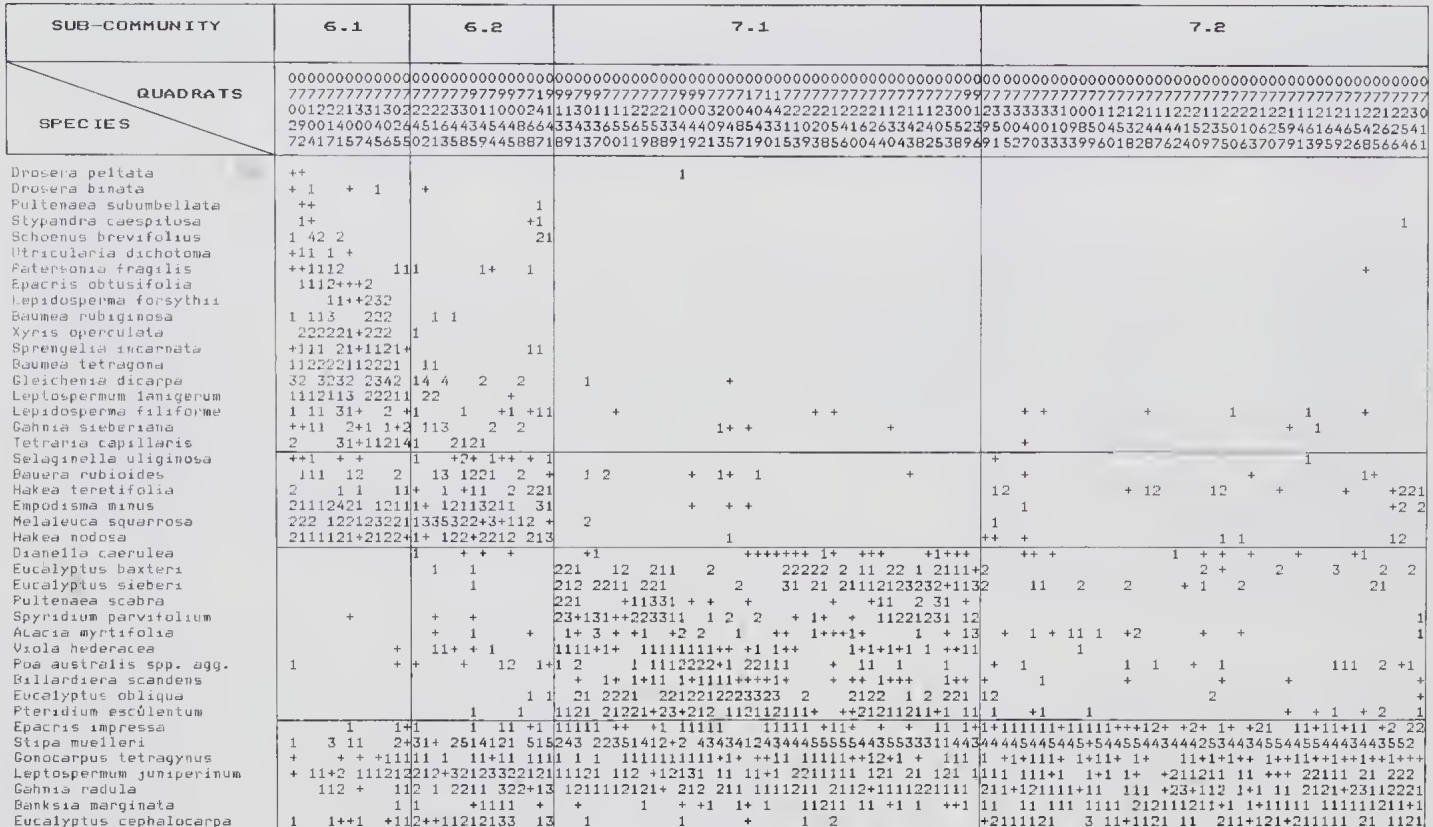
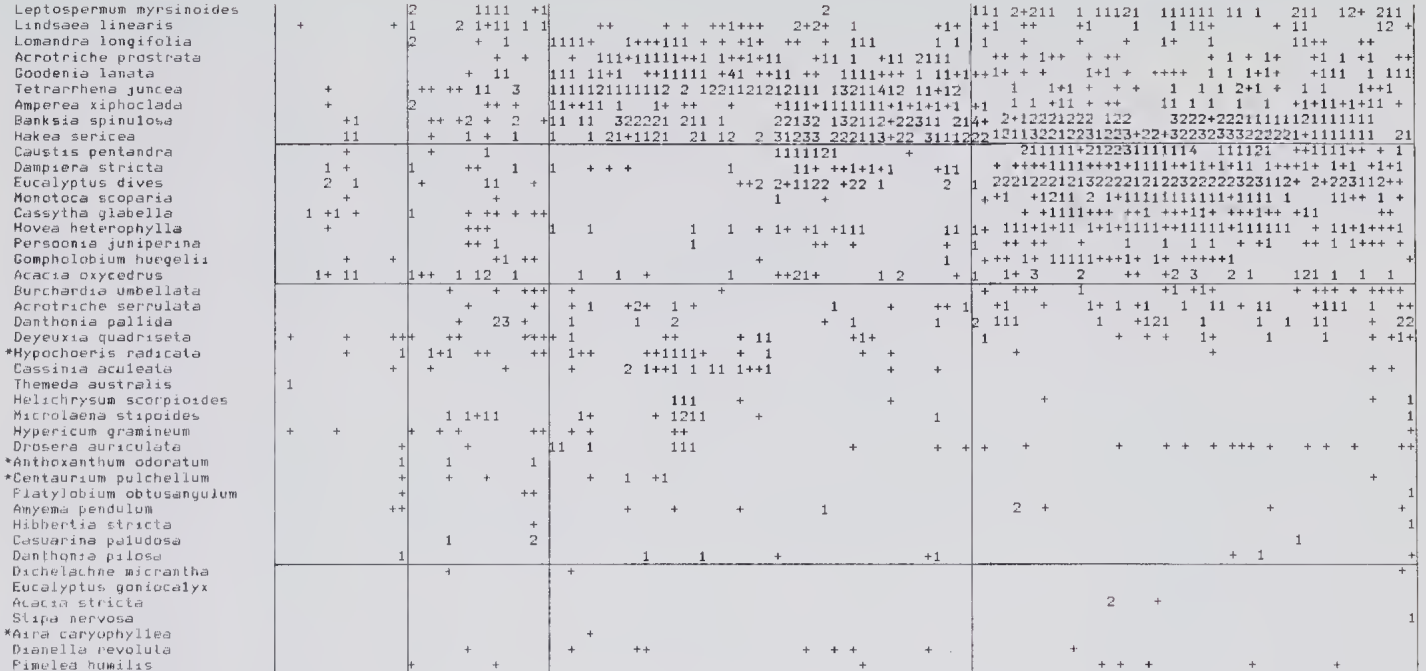
Eucalyptus sieberi
Platylobium formosum
Amperea xiphoclada
Eucalyptus baxteri
Correa reflexa
Tetratheca ciliata
Pultenaea scabra
Olearia rugosa
Banksia spinulosa
Gonocarpus teucrioides
Lomandra filiformis
Bedfordia arborescens
Bauera rubioides
Pultenaea mollis
Tetratheca stenocarpa
Dampiera stricta
Acacia oxycedrus
Cassytha pubescens
Acacia difformis
*Centaurium pulchellum
Geranium potentilloides
Blechnum cartilagineum
Eucalyptus dives
Stipa muelleri
Gnaphalium japonicum
Danthonia pilosa
Dianella caerulea
Lomatia ilicifolia
Acacia obliquinervia
Prostanthera lasianthos
Polyscias sambucifolius

Table 4. Two-way table of Communities 10 and 5.5.6–5.9.

SUB-COMMUNITY	10.1	5.6	5.7	5.8	5.9
QUADRATS / SPECIES	0000000000000000000000000000000000000000000000000000000000000000 3334434844444444884444444888888884448899999333939330 0001100000000000000000000000000000000000001000011101111 3339924266563425552469962879848872218608877333790990 4354540016426917012875453590491358798940394405850430				
Eucalyptus pauciflora	++1+32				
Casuarina littoralis	++143				
Acacia paradoxa	12 ++				
Lepidosperma laterale	1123	1		+	+21 1 +
Themeda australis	+51 4+				
Daviesia latifolia		+22+3 3+			
Platylobium obtusangulum	++	1 ++11122+11212 1			
Gonocarpus teucrioides		1 +11+112+21222 +1	12	1 +	+
Banksia marginata		1 ++221 11 +		1	2+1
Hypericum gramineum	+++	++ 1 11 2 1	++	++11	+ + + ++
Acacia stricta		2 2++ + 33	+	+ 1 ++1	++121+11
Drosera auriculata		+ 1++++1 1++	++	1++++ +	+ +++ +
Epacris impressa		1 ++2+11 1222 +		1 +	2111 ++
Gahnia radula	21131+	2 22222323+ 2222+13	21	2122411+11	3322 2 +
Leptospermum juniperinum	1++3	323 2 2323333332+3	21	11212+33	121 1 2
Eucalyptus obliqua		433332 2+33222	333	3211+4 32	4323231332 34
Pteridium esculentum	1 11	5 1111+1 2 21124	423	211 1+++3	4323331343234
Tetrarrhena juncea		3233223+333242 52		2+ 1	21323522
Acrotriche serrulata	+	+ 1+1++2212121+ 1	+	+1+1	+
Billardiera scandens	1	1 +1 2 +11+ 1+ 1		+11++1+ 1	1 1
Hakea sericea		2222+21 + +2+ +		22	
Acacia myrtifolia		+ 1+2 2 1+2+2 +1			+ 1
Glycine clandestina			11+	+1 +++1	++++++
Dichondra repens	+		112	11+12++ 1	++ ++
Clematis aristata		1 +	21	1111 12	+ + ++++ 1++
Oxalis corniculata	+++		111	+1 1 1+	1 ++ ++ ++++
Viola hederacea	++	11	11+	+++11+1+11	+1++11+111+++
Poa australis spp. agg.	++ +	1	+12	21 1 +1	1 222 21122
Gonocarpus tetragynus	+++11+	1 +	1	111 1+	11 11+++ +1
Acaena anserinifolia	2		11	+2 1+	1 + + +++ +
*Hypochoeris radicata	+++		2	2+11	1+ 1 +++11+++
Microlaena stipoides	1		112	12311 11	21 12 2
Lagenifera stipitata			1++	1 1 1+	+ + ++1
Comesperma volubile	++	1 + +	1+	1 +	++ + +
Lomandra filiformis	+ + +	+ 21	++		1+ + ++
Poa tenera					
Acrotriche prostrata				1	3 22 + 22
Hydrocotyle laxiflora	+				1++ + ++
Eucalyptus radiata	1 1	+ 2		3	++1 1 +1 12 32 + 21
Goodenia ovata		1		++3+	1 + + 1
Acacia mearnsii	1+ +	23		2 23	2
Pultenaea daphnoides		+ + 1 +		1 + 2 +1	3
Adiantum aethiopicum					1 + 1+
Lomandra longifolia	+1 2	+	1	1	+ 1 1 1 +

Table 5. Two-way table of sub-communities 6.1, 6.2, 7.1 and 7.2.




Leptospermum myrsinoides
Lindsaea linearis
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Acrotriche prostrata
Goodenia lanata
Tetrarrhena juncea
Amperea xiphoclada
Banksia spinulosa
Hakea sericea
Caustis pentandra
Dampiera stricta
Eucalyptus dives
Monotoca scoparia
Cassytha glabella
Hovea heterophylla
Persoonia juniperina
Gompholobium huegelii
Acacia oxycedrus
Burchardia umbellata
Acrotriche serrulata
Danthonia pallida
Deyeuxia quadriseta
*Hypochoeris radicata
Cassinia aculeata
Themeda australis
Helichrysum scorpioides
Microlaena stipoides
Hypericum gramineum
Drosera auriculata
*Anthoxanthum odoratum
*Centaurium pulchellum
Platylobium obtusangulum
Amyema pendulum
Hibbertia stricta
Casuarina paludosa
Danthonia pilosa
Dichelachne micrantha
Eucalyptus goniocalyx
Acacia stricta
Stipa nervosa
*Aira caryophyllea
Dianella revolula
Pimelea humilis
Dipodium punctatum
Lepidosperma tortuosum
Pultenaea hispidula
Pultenaea mollis
Dipodium punctatum
*Rubus fruticosus spp. agg.
Danthonia setacea
Daviesia virgata
Dillwynia sericea
Acacia difformis
Goodenia ovata
Platylobium formosum
Correa reflexa
*Erica lusitanica
Helichrysum dendroideum
Bursaria spinosa
Xanthosia dissecta

Table 6. Two-way table of sub-communities 7.3–7.5.

SUB-COMMUNITY	7.3	7.4	7.5	U
QUADRATS / SPECIES	000000000

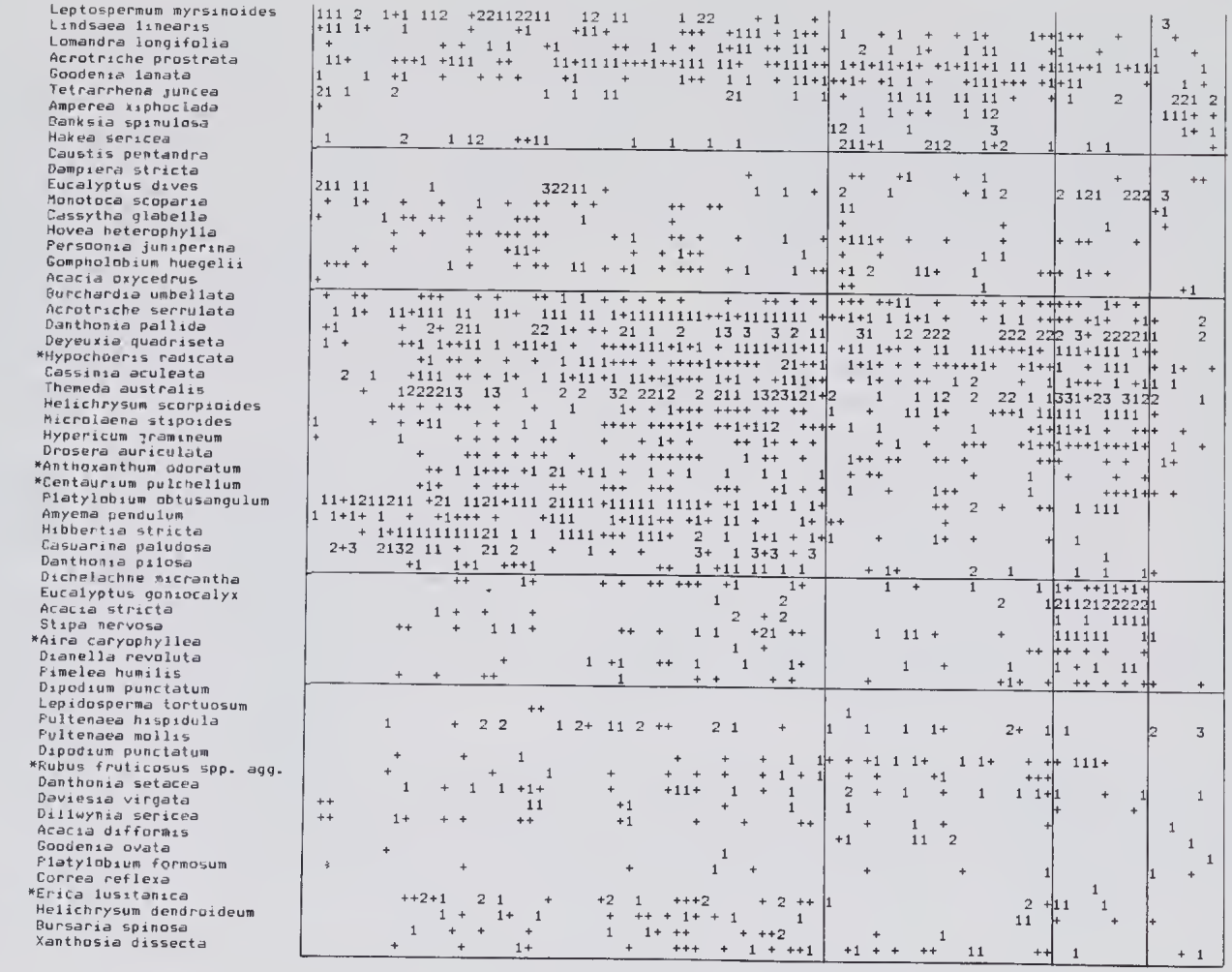

Leptospermum myrsinoides
Lindsaea linearis
Lomandra longifolia
Acrotriche prostrata
Goodenia lanata
Tetrarrhena juncea
Amperea xiphoclada
Banksia spinulosa
Hakea sericea
Caustis pentandra
Dampiera stricta
Eucalyptus dives
Monotoca scoparia
Cassytha glabella
Hovea heterophylla
Persoonia juniperina
Gompholobium huegelii
Acacia oxycedrus
Burchardia umbellata
Acrotriche serrulata
Danthonia pallida
Deyeuxia quadriseta
*Hypochoeris radicata
Cassinia aculeata
Themeda australis
Helichrysum scorpioides
Microlaena stipoides
Hypericum gramineum
Drosera auriculata
*Anthoxanthum odoratum
*Centaurium pulchellum
Platylobium obtusangulum
Amyema pendulum
Hibbertia stricta
Casuarina paludosa
Danthonia pilosa
Dichelachne micrantha
Eucalyptus goniocalyx
Acacia stricta
Stipa nervosa
*Aira caryophyllea
Dianella revoluta
Pimelea humilis
Dipodium punctatum
Lepidosperma tortuosum
Pultenaea hispidula
Pultenaea mollis
Dipodium punctatum
*Rubus fruticosus spp. agg.
Danthonia setacea
Daviesia virgata
Dillwynia sericea
Acacia difformis
Goodenia ovata
Platylobium formosum
Correa reflexa
*Erica lusitanica
Helichrysum dendroideum
Bursaria spinosa
Xanthosia dissecta

Table 7. Two-way table of sub-communities 8.1 and 8.2.

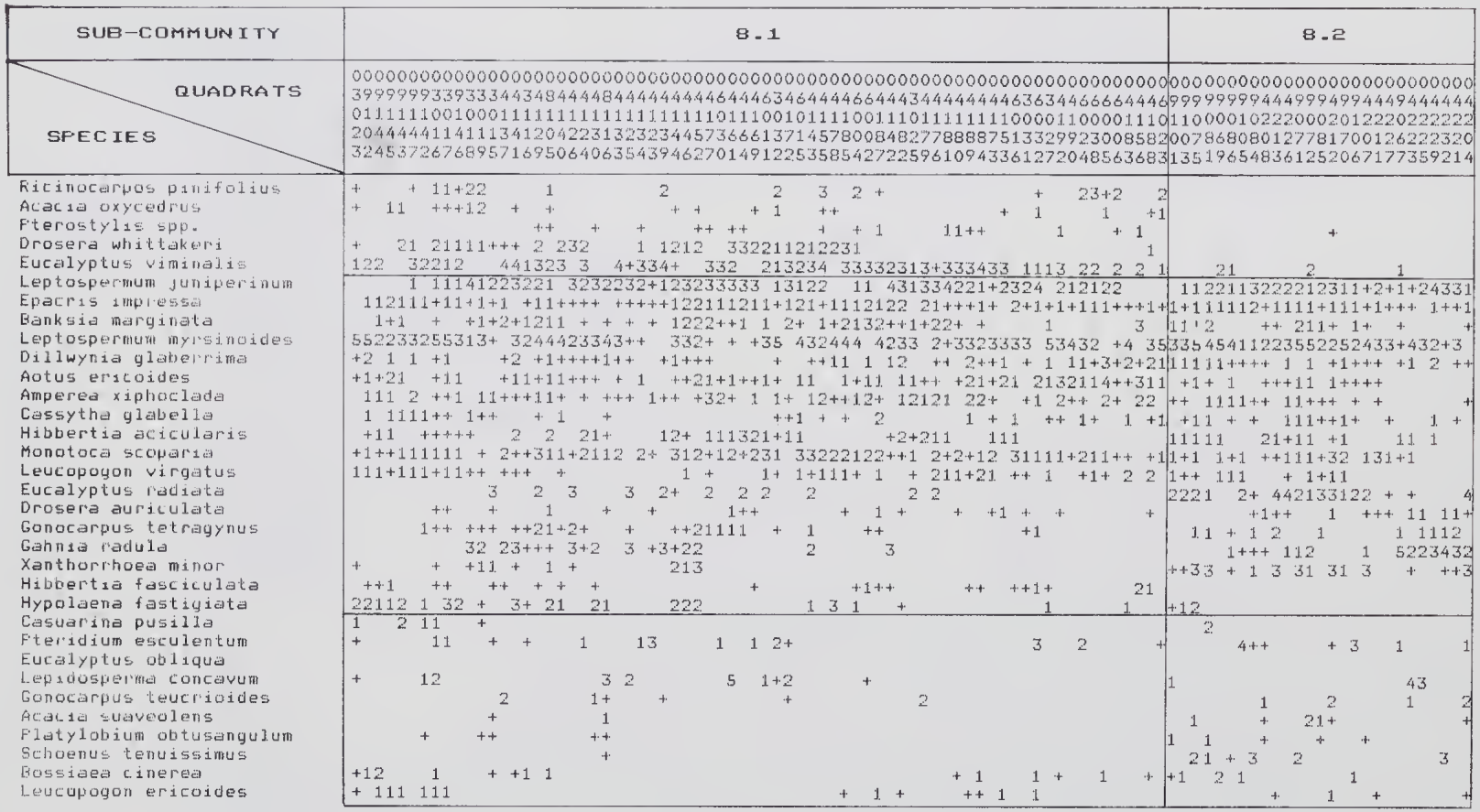


Table 8. Two-way table of sub-community 8.3.

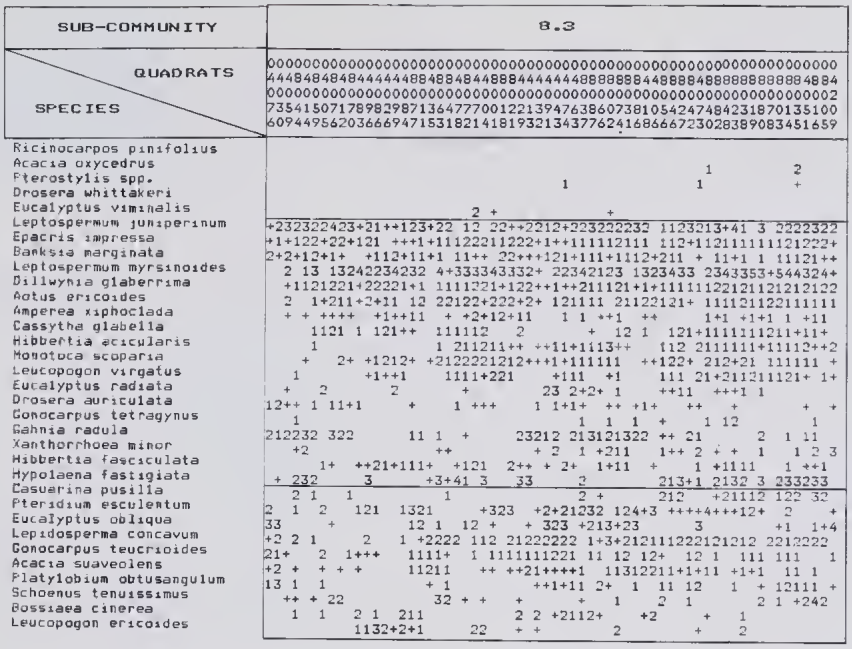


Table 9. Two-way table of sub-communities 8.4–8.6.

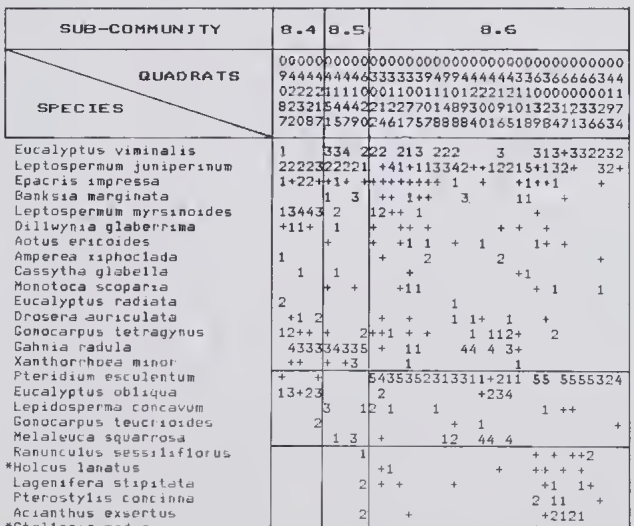


Table 10. Two-way table of Community 9.

SUB-COMMUNITY	9.1	9.2	U
QUADRATS / SPECIES	000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000 3444B443443333333338388344344433483994333333443333388888888888384484343481 1111111011111101111111102202221112100201100022100001011011110100110212111 1562022725110080001101080191001221771112227103887919009110908923932239139 4908212604206504381592435448367849630299014923563908737430571372612027 7		
Casuarina paludosa	3 +1+ + 2++ + 3 3 1 + + 2		
Eucalyptus viminalis	1 42 3+ 1 3 3 1 2 11 32 4 2 +2		
Eucalyptus ovata	3 1 1+ + 1 + 2 +12 3 3 22		
Patersonia occidentalis	3 1 + + 2 1 1 1 ++ + 1		
Lepidosperma laterale	231 1 4 + 1 ++++1 + 2 + + 1+ 1+1 111 11+ 2 + 1		
Leptospermum juniperinum	++2 4+34233151131+533242++221+++32 + 3 4++ 21+11 11211+1 11++ 1++ 4 3		
Hypericum gramineum	+2 11+ 1+++ + ++11+ 22++2+121++ ++ 21+++ 11 1+1+1++1 + 1 + 1+		
Arrotriche serrulata	1++ + ++ +1 ++12 1+2 12+ +231++ 1 1++ ++ +2 +++++++1111+1++		
Gonocarpus tetragynus	12 + +++ +1+ 1 11+ + 1+ 1 ++++++121+++11111111+1+ 1 1 + +		
Themeda australis	3112+ 111+225 132215 4 32311+22++1+233 1+121121121 1		
Epacris impressa	1 + 11 +11 1+++ 11+112 1++ + + +21+ +2 +++11 + + +		
Hibbertia stricta	22+ +1+11+11++1 + 1+12+ + 1 + ++ 1 111 1+1 ++++ 1 +		
*Hypochoeris radicata	+ ++ + ++ ++++ + +11+1 + ++ 211 ++ ++ ++++2+1+1+1112+ + 2 + 1		
Drosera auriculata	+++ + 11+1++1+1 +1 1 ++1++++121+11+111++ 12 + +		
Bossiaea prostrata	11+ +1++ 1 + ++ ++ + +++ 111 1 ++		
Pteridium esculentum	1 + 4 1 +1 2+2 +212+ + 215221+2 +11++1+2 255 114 +		
Poa australis spp. agg.	1 1+ + 11+ 2 +1422 11+11 2 +++12 111 +11 + + 1		
Eucalyptus radiata	++ 222 2 22 11 22323311 212 211 2 211 312 4		
Lomandra filiformis	1++ 11 +1 11+1 1 11 ++++++ +1+++++11+11+111 1		
Viola hederacea	1 + 1 11 21 +1 12 + +1 ++++1+1++ +++ + +2 ++1		
Pimelea humilis	+ 1 +++ + +1 ++ +++ + +11+1++ +		
Lomandra longifolia	1 + 1 + 1+ ++1 2 +2 1 1 211 +1++2+ +21 1		
Acacia verticillata	+ 1 + 1 + 1 + + ++1++ +++1 111 2 1		
Lagenifera stipitata	+ + 11 1+ + +++ 1+ 1++ 1 + +		
Oxalis corniculata	+ + 1+1 ++ +++ +++ ++ +1+++ + +		
Acacia paradoxa	+2 12 1 1 ++ 1++2+112112 1+ +		
Billardiera scandens	+ ++ 1+ ++1 + + + ++ + ++ 1++ 1		
Burchardia umbellata	+ +1 1 +1 + +++ ++ + ++++ ++ 1+1+11 +		
Tricoryne elatior	11+1++ ++ +++ + 1111+2+11		
Microlaena stipoides	+ + 1++ + 223 1+++ 112111+ 113++ 1 5		
Schoenus apogon	2 + 1 + 1 + + + 1+111+ 1 + + +		
Stipa pubescens	+ 1 1+ + + + +++1111111+1		
Poranthera microphylla	1 + + ++ ++ +11111 +++1 +		
*Holcus lanatus	+1 + 1 +++ + + ++ 1 1 +1 2 1		
Deyeuxia quadriseta	2 1 + + 1 + ++1 1 1111+++111 1		
Dichopogon strictus	+ + ++ + +11++1 +++ +		
Exocarpos cupressiformis	1 + + + +11+1 + +		
Acacia melanoxylon	+ 1 + 1 1 3 + 1++1 1 1 +		
*Briza minor	+ 1++ ++1++ + +		
Casuarina littoralis	2 + 1121 11 3 1		
Acacia mearnsii	+ ++ 22 1+ 1+ 1 3		
*Anthoxanthum odoratum	2+ 11111 2 31+ 3		
*Aira caryophyllea	121111 + + 1		
*Briza maxima	1 ++1+ + 1+ 1		
*Rubus fruticosus spp. agg.	+1 1 + 1++ + 21 + +		
Pentapogon quadrifidus	+ 1 + ++1+ 1+		
Eucalyptus obliqua	1 + 23 33+333 23 33 3433211 1 1 2 2 2		
Xanthorrhoea minor	1 +1 1++1+21 1 + 2+ 3 1 1 +11 +1 2+ 1+ + 1		
Gahnia radula	1333 2 +412211 1 3+ 32 1 31+ 11+++ 1233 +14 + 4 3 2 2		
Platylobium obtusangulum	1 + 11+1 + +++ + +1 + 1 + +1 + + +		
Opercularia varia	1 + ++ + 1 + ++ 1 + + ++ + ++1 1 ++ +		
*Pinus radiata	+ + 1 + + 11+ +1 +		
Comesperma volubile	++ 11 + + ++1 + + + ++ + + +1+ ++ +		
Dianella revoluta	+ 1 + ++ + + ++++ + + + 1 +		
Banksia marginata	+ ++ ++4 ++ 11 ++++ ++2 ++ +		
Dillwynia glaberrima	111 +111 + 1 ++ + 1 1 1		
Astroloma humifusum	1 + + + + +1 + 2 + + ++ 1 +		
Gonocarpus teucrioides	+ + 21 222 1 1 1 1 1		

Table 11. Two-way table of Communities 12, 13:13.1–13.3 and 14 and sub-communities 6.3 and 18.2.

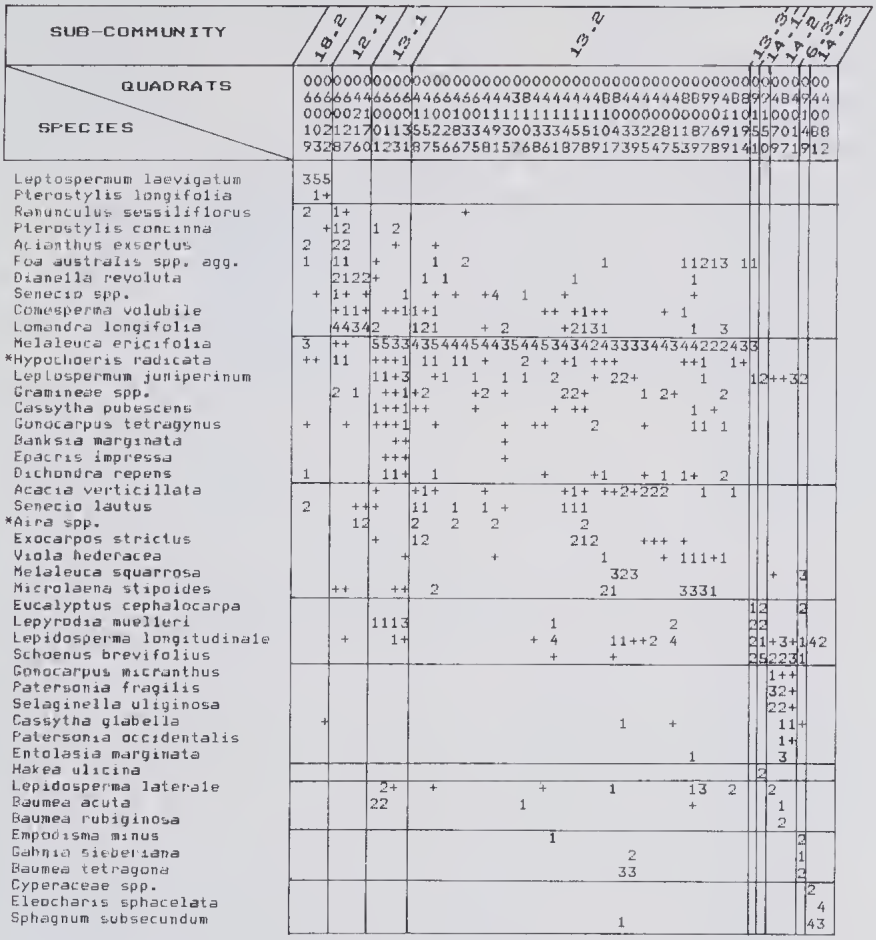


Table 12. Two-way table of sub-community 13.4.

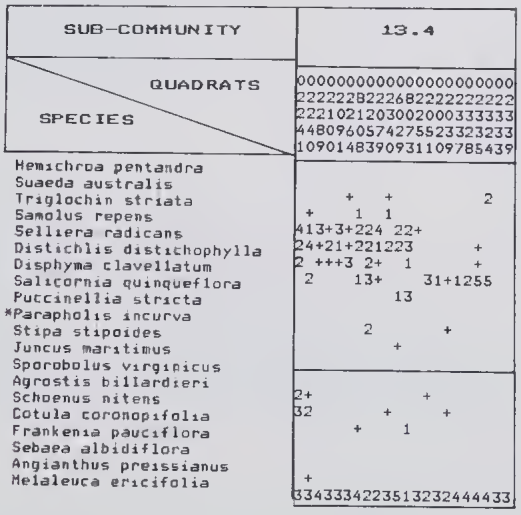


Table 13. Two-way table of Community 15.

SUB-COMMUNITY	15.1	15.2	15.3	15.4	15.5	15.6	U
QUADRATS / SPECIES	0000000000000	0000000000000	0000000000	0000000000000000000000000	0000000000000000000000000	0000000000000	0000000000000
	8888888888888	8888888888888	8888888888	4444444884488888484484884	4444444444444444844444884	4444444666464644	4444444444484484
	0000000000000	0000000000000	0000000000	0000000010000000000000000	0000000001001000000000001	1111110001010	0000011000000000
	2435192830301	5666423006	0630496210135919310665525	4604454707403585078997	5666665011607	0793360015825860
	6324514349960	2718593849	8812774873265278061043855	5932466205144087705031	4326780740591	8279012089200 29
Schoenus latelaminatus	+ +						
Selliera radicans	1+						3
Hakea nodosa	11			2 2 ++			
Olearia ramulosa	1+		+		+		+
*Cicendia filiformis	11						
Gahnia trifida	+2						
Mitrasacme paradoxa	1++		+				
*Leontodon taraxacoides	++		+				
Baumea juncea	222		+		2		43
Stylidium despectum	+1	+ +	+ +				
Deyeuxia quadriseta	11+	1 +	+1	1		+ + 1 +	+
Aphelia gracilis	++	+					
Stylidium beaugleholei	++	++++	2				
Boronia parviflora	11+	1 ++	+ 111	1 + + 1 +++	2 +		1+
Centrolepis aristata	+++	1 ++1+	+ +1		+		
Goodenia humilis	11+	1 +111	+1 1 1	2 +2 +	++ + 1 1	1 1	1 1
Danthonia setacea	121	+1 2 2	21+1 1	2 +			2 1
Microlaena stipoides	1	+ 11 ++1	1 213 1+	+		+ + 1	
Opercularia varia	+	+++11 +	++++1++1 +	+ + + 1	+ +	+ + +	
Caesia parviflora	+ +	+11+1 + ++	+1 ++ +11+	+			
Stypandra caespitosa		+1++1+122 +	++1+2i+2	1 1			
Xanthosia pusilla		+1+1211++1	++1+ + + 1	++ +	1		+
Drosera pygmaea	11+	1+1+11111	+ ++ 111	+	+ + 1 +	+	+ 1
Casuarina pusilla	+12	33212111121	313+2+113	3 31 11	4		3
Conocarpus micranthus	+	+ 1 11	+++1 2 1 1	1 + 1 22	2		
Patersonia fragilis	1	+ 1 1	12 22222	1 21 + 2	+	+22	3 2
Schoenus apogon	21	11 +112+	+1 1+	+	+		2
Entolasia marginata	112	212 111333	1 3 + +	3			
Viola sieberana	+	+1+11+ 11	+ +	+ + +	+ + 2+ +	1+ +	+ 1 +
Thysanotus tuberosus	+ 1	+ 11+1 1 +	1 + +	+			
Stipa hemipogon		122 121 1	+ +2	1			
Chamaescilla corymbosa		11+ 1111	1	1		11 +	
Hibbertia stricta		+1 +21111+1			2 1 2 2	1 222 +211+1 1	
Lepidosperma neesii		3221322232		22 1	1	423 4 3522	
Xanthosia dissecta		+ +1	++1+ + 1	+ + + + + ++ +	++ + 2+ 1	1	+
Schoenus tenuissimus		1 1 1	22 1+ +2223	432 21211 1 3 13	+	13	
Melaleuca squarrosa			21211	32332+44++ 2+++33+23 2 +	3 + 3 +		444 + 3+
Empodisma minus			1111 121	33342222222212 2 3222 1	1 3 3		2
Selaginella uliginosa		1 +	11 2223	12432113+121112212 1	2 2 2 2 +		+ 1 1
Epacris obtusifolia			+ 121	232321121+222 311 +21	+		+
Sprengelia incarnata			++++	133231223 + 1 2 3	+		

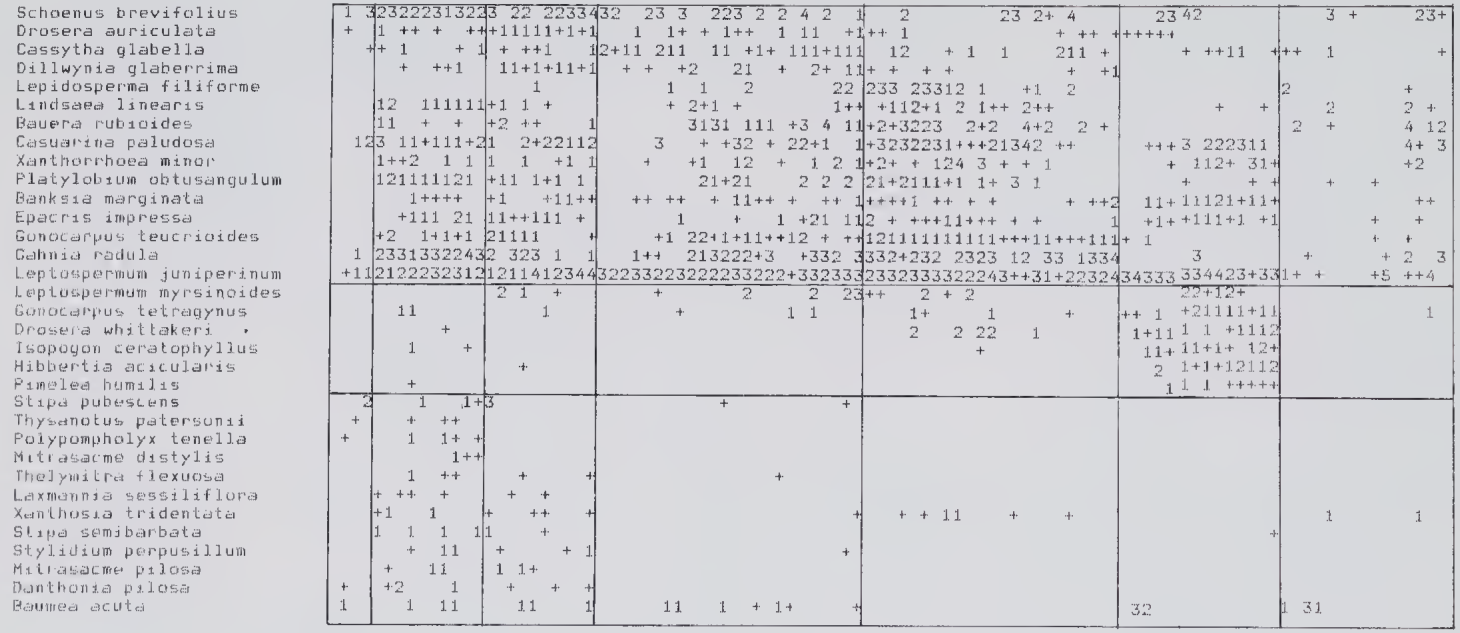

Schoenus brevifolius
Drosera auriculata
Cassytha glabella
Dillwynia glaberrima
Lepidosperma filiforme
Lindsaea linearis
Bauera rubioides
Casuarina paludosa
Xanthorrhoea minor
Platylobium obtusangulum
Banksia marginata
Epacris impressa
Gonocarpus teucrioides
Gahnia radula
Leptospermum juniperinum
Leptospermum myrsinoides
Gonocarpus tetragynus
Drosera whittakeri
Isopogon ceratophyllus
Hibbertia acicularis
Pimelea humilis
Stipa pubescens
Thysanotus patersonii
Polypompholyx tenella
Mitrasacme distylis
Thelymitra flexuosa
Laxmannia sessiliflora
Xanthosia tridentata
Stipa semibarbata
Stylidium perpusillum
Mitrasacme pilosa
Danthonia pilosa
Baumea acuta

Table 14. Two-way table of Communities 16, 17, 18:18.1, 19 and 20.

SUB-COMMUNITY	16.1	17.1	18.1	19.1	20.1	U
QUADRATS / SPECIES	000000000000000000000000000000000000000000000000000000000000 998988999444444944934444444844433433399449881 001011000111221011011122201111111111100220111 982922999110330900921133320111122199999393922 093114632357796898574185605820754687943720					
Cardamine debilis	11 +					
*Polycarpon tetraphyllum	++ + +					
Swainsonia lessertiifolia	11					
Caryophyllaceae spp.	11					
Compositae spp.	++ +					
*Ammophila arenaria	212				2	
Spinifex hirsutus	21					
Olearia axillaris	321 + + 1				+	
Senecio spp.	+++	12 1 +			+	
Helichrysum paralium	131 11					
Calocephalus brownii	12 2 11					
*Holcus lanatus	1 1+++ +				2	+ 1
Poa poiformis	2+ +5352 1 + 2 3					+2 2
Acaena anserinifolia	+ +1+11 1 2 2			++		
Dianella revoluta	1+ 11 111 1 + 1 + +			1	1	11
Scirpus nodosus	22+12121 11 ++ + + + + 211			+21		
Clematis microphylla	+ 1 3 11 +11111+1+ 11 ++1			+1 + +	+++	++ 1
Dichondra repens	+ ++ + + 12+122++ 1 21 1			+1	+	+
Leucopogon parviflorus	++ 1 + 122++323+1233+1+ 243			+32311	+1	1
Senecio lautus	+1 1 +1 1+21+1 + 11 12			1+		++
Tetragonia implexicoma	3 +4 ++ 1 2 1+				12	22
Tetragonia tetragonioides	+1 2 21 + 2 3					
Daucus glochidiatus	1++ +1+11++ 21 12			1	+	
Rhagodia baccata	111 1 +++2+321+ +2				12	+31
Correa alba	1 2 +++ + 1 2 3 1 +					
*Asparagus asparagoides	++ +1 242 4				1	+
Lophocolea semiteres	11 2+ + 21+ 2+1 11			1		
Leptospermum laevigatum	3 +34332334243454+33344+3			+	11	31
Banksia integrifolia	1 + 2331223342+ 1+					+
Pteridium esculentum	5 2+ 155 15					+2
Eucalyptus viminalis	1222					
Melaleuca lanceolata					33	
*Ehrharta longiflora					13	
Parietaria debilis	1 +				11	
*Sonchus oleraceus	1 1++ 1 ++ + +				11	+
*Stellaria media	+ 1 + + 1				+1	+1
Bursaria spinosa	1 1 1 + +++ 1			+	2	
Casuarina stricta	2+				33	
Myoporum insulare	1 + 2 + 22 +					+2
Acacia longifolia	2 12 ++ + 2			1	1	
Poa australis spp. agg.	+ 1			11	+1	
Oxalis corniculata	+ 1+1 +			++		+
*Hypochoeris radicata	+ + 11+ 1 1			++	++	1 +
Melaleuca ericifolia	1					345
*Cerastium glomeratum	11+1 + 2				+	
Crassula macrantha	++ 2 + + 21			1		
Crassula sieberiana	+ + 1 +21 ++ 2			1	+	
Geranium spp.	+ 1++ 1				+	
Lepidosperma gladiatum	+ 3 2 21 1 21			+		
Pomaderris multiflora	2 3 ++				2	

COOL TEMPERATE RAINFOREST : SUB-COMMUNITY WPC 1.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Blechnum wattsii	100	2	Todea barbara	89	1	Australina muelleri	56	1
Dicksonia antarctica	100	3	Hedycarya angustifolia	67	1	Carex appressa	56	1
Nothofagus cunninghamii	100	2	Hymenophyllum australe	67	1	Parsonsia brownii	56	+
Atherosperma moschatum	89	1	Eucalyptus regnans	67	1	Pomaderris aspera	56	1
Grammitis billardieri	89	1	Polyphlebium venosum	67	1	Tetrarrhena juncea	56	1
Blechnum nudum	89	2	Rumohra adiantiformis	67	1			

NO. OF SITES: 9 (0.88% of total)

DISTRIBUTION: Restricted to the far north-east of the Study Area along the ranges north-east of Mt. Beenak.

ENVIRONMENT: Protected, high-altitude, gullies in the Study Area. Median annual rainfall is 1300-1400 mm.

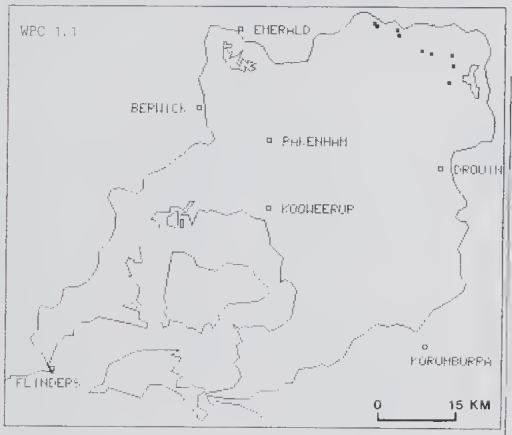
ALTITUDE: Mean = 468 m, Highest = 790 m, Lowest = 228 m.

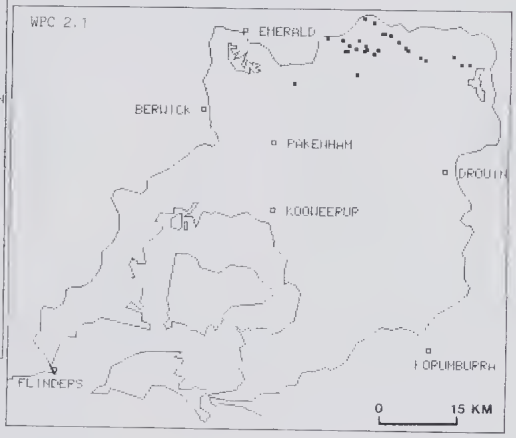
STRUCTURE: Tall woodland

MEAN FLORISTIC RICHNESS: 26 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: This sub-community represents what is commonly known as "fern gully" (Patton, 1933) and is a southern extension of community UYH 6 Gullan *et al.* (1979), the Cool Temperate Rainforest of the Central Highlands. It is characterised by a variety of pteridophytes, including tree ferns and epiphytic ferns, and is dominated by *Nothofagus cunninghamii* (Antarctic Beech), Victoria's only representative of the Fagaceae.

In WPC 1.1, however, *N. cunninghamii* seldom grows as large as it does in the wetter and better developed Cool Temperate Rainforest elsewhere in Victoria. Similarly this vegetation only forms a narrow band (100-300 m wide) along creeks and as a consequence is extremely vulnerable to disturbance (e.g. logging, roading) of the surrounding vegetation.





WET SCLEROPHYLL FOREST : SUB COMMUNITY WPC 2.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Pomaderris aspera	100	1	Tetrarrhena juncea	81	1	Todea barbara	52	1
Clematis aristata	96	1	Australina muelleri	70	1	Fieldia australis	48	1
Alsophila australis	93	2	Histiopteris incisa	67	+	Rumohra adiantiformis	48	1
Dicksonia antarctica	93	3	Eucalyptus regnans	63	2	Bedfordia arborescens	48	1
Acacia dealbata	85	1	Viola hederacea	63	+	Lepidosperma elatius	48	1
Hedycarya angustifolia	85	1	Polystichum proliferum	59	1	Acacia melanoxylon	48	1
Blechnum wattsii	85	2	Blechnum nudum	59	2			
Coprosma quadrifida	81	1	Carex appressa	56	+			

NO. OF SITES: 27 (2.65% of total)

DISTRIBUTION: Occurring in the ranges in the far north of the Study Area - Blue Range and the range north-east of Mt. Beenak.

ENVIRONMENT: Protected high altitude gullies in the Study Area. Median annual rainfall is 1300-1400 mm.

ALTITUDE: Mean = 366 m, Highest = 695 m, Lowest = 130 m.

STRUCTURE: Tall woodland

MEAN FLORISTIC RICHNESS: 28 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: This sub-community contains two types of vegetation which, although visually distinct at their extremes, grade into each other. Both require a constant source of water but in different forms. At one extreme is the fern gully vegetation, dominated by the tree ferns *Dicksonia antarctica* and *Alsophila australis*, which occurs around free flowing water. At the other extreme tall stands of *Melaleuca squarrosa*, with *Todea barbara* as the dominant understorey species, occur on swampy flats which have poorly-drained, water-logged soils. Most sites were intermediate between the two extremes.

Fieldia australis, a character species of this sub-community, is the only species of epiphytic dicotyledon native to Victoria.

WET SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 2.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Coprosma quadrifida	96	1	Viola hederacea	88	1	Pandorea pandorana	65	1
Pomaderris aspera	96	2	Clematis aristata	88	1	Acacia dealbata	65	2
Alsophila australis	92	2	Sambucus gaudichaudiana	81	+	Hydrocotyle geraniifolia	62	+
Eucalyptus cypellocarpa	92	1	Pteridium esculentum	81	1	Olearia lirata	62	1
Tetrarrhena juncea	92	1	Dicksonia antarctica	77	1	Blechnum cartilag.neum	64	2
Polystichum proliferum	92	1	Bedfordia arborescens	73	1	Eucalyptus obliqua	54	2
Australina muelleri	88	1	Olearia argophylla	73	1	Goodenia ovata	50	1
Hedycarya angustifolia	88	1	Oxalis corniculata	69	+			
Lepidosperma elatius	88	1	Acacia melanoxylon	65	1			

NO. OF SITES: 27 (2.65% of total)

DISTRIBUTION: Restricted to the northern slopes of the Mt. Towt range, Black Snake Range and Blue Range with several occurrences near the northern shores of Cardinia Reservoir.

ENVIRONMENT: Intermediate altitude protected slopes. Median annual rainfall is 1100-1400 mm.

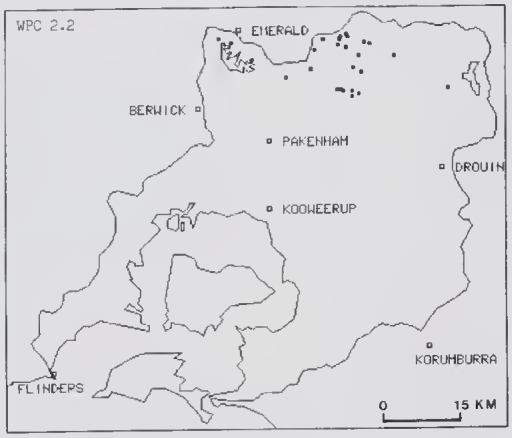
ALTITUDE: Mean = 307 m, Highest = 530 m, Lowest = 100 m.

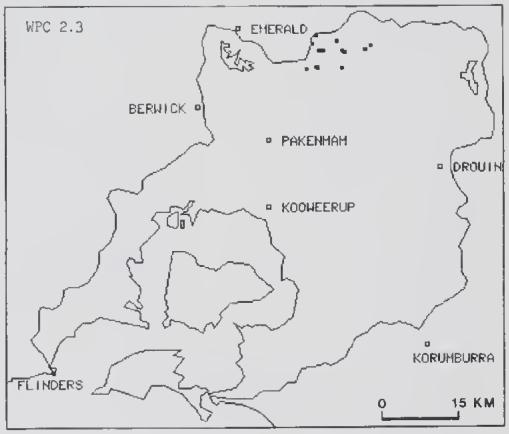
STRUCTURE: Tall open-forest to Tall woodland

MEAN FLORISTIC RICHNESS: 34 species per site. MEAN WEED COMPOSITION: 3% of species, 2% of cover.

NOTES: This sub-community represents a typical mixed eucalypt Wet Sclerophyll Forest in close proximity to a fern gully. Many of the sites contain very large tree ferns (both *Dicksonia* and *Alsophila*) - 568 m tall and up to 0.5 m diameter. Logging (both recent and long past) was evident at or very nearby a number of sites and at some sites the eucalypt canopy was quite poor.

WPC 2.2 has affinities with SL 4a (Gullan *et al.* 1979).





WET SCLEROPHYLL FOREST :SUB-COMMUNITY WPC 2.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Coprosma quadrifida	100	1	Goodenia ovata	93	1	Blechnum cartilagineum	71	1
Alsophila australis	100	1	Oxalis corniculata	86	+	Geranium potentilloides	64	+
Lepidosperma elatius	100	1	Viola hederacea	86	1	Gonocarpus teucrioides	64	1
Pteridium esculentum	100	2	Acacia verticillata	86	1	Olearia lirata	64	1
Tetrarrhena juncea	100	2	Bedfordia arborescens	79	1	Pandorea pandorana	64	1
Clematis aristata	93	1	Eucalyptus cypellocarpa	79	1	Spyridium parvifolium	57	1
Eucalyptus obliqua	93	2	Pomaderris aspera	71	1			

NO. OF SITES: 14 (1.37% of total)

DISTRIBUTION: Occurring at the western end of the Blue Range and Black Snake Range.

ENVIRONMENT: Intermediate altitude protected slopes. Median annual rainfall is 1200-1400 mm.

ALTITUDE: Mean = 262 m, Highest = 380 m, Lowest = 120 m.

STRUCTURE: Woodland

MEAN FLORISTIC RICHNESS: 32 species per site. MEAN WEED COMPOSITION: 3% of species, 1% of cover.

NOTES: A lower altitude, and consequently drier version of WPC 2.2. This is indicated by the absence of *Eucalyptus regnans, Dicksonia antarctica, Hedycarya angustifolia* and *Australina muelleri* and the presence of *Spyridium parvifolium* and *Acacia verticillata*. Most sites have been logged in the past, with the main sawlog species being *E. obliqua* and *E. cypellocarpa*, and in some of these sites the ground layer is very disturbed and dominated by *Pteridium esculentum* and *Tetrarrhena juncea*.

WPC 2.3 has affinities with SL 4b (Gullan *et al.* 1979).

WET SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 2.4

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Tetrarrhena juncea	100	2	Olearia lirata	80	1	Pimelea axiflora	56	1
Alsophila australis	96	1	Eucalyptus cypellocarpa	80	1	Zieria arborescens	52	1
Pteridium esculentum	96	1	Acacia dealbata	72	2	Acacia verticillata	48	1
Pomaderris aspera	96	2	Bedfordia arborescens	68	1	Olearia argophylla	48	1
Lepidosperma elatius	88	1	Prostanthera lasianthos	68	1	Hedycarya angustifolia	48	+
Viola hederacea	88	1	Eucalyptus regnans	64	2	Acacia obliquinervia	48	1
Clematis aristata	84	1	Coprosma quadrifida	60	1			
Goodenia ovata	84	1	Eucalyptus obliqua	60	2			

NO. OF SITES: 25 (2.45% of total)

DISTRIBUTION: Apart from two southerly occurrences, restricted to the north of the Study Area on the Blue Range and around Rysons Creek.

ENVIRONMENT: Higher altitude protected slopes. Median annual rainfall is 1200-1400 mm.

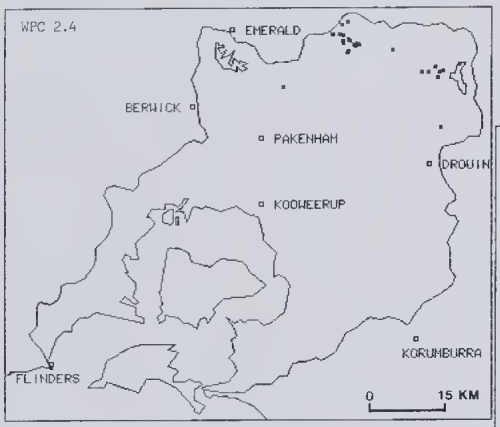
ALTITUDE: Mean = 383 m, Highest = 600 m, Lowest = 110 m.

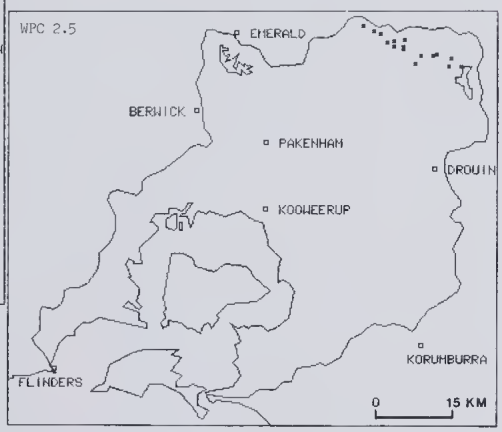
STRUCTURE: Tall open-forest

MEAN FLORISTIC RICHNESS: 27 species per site. MEAN WEED COMPOSITION: 1% of species, 1% of cover.

NOTES: This sub-community has affinities with UYH 8 (Gullan *et al.* 1979) but its lower altitude is less suitable for *Eucalyptus regnans* therefore, in contrast to UYH 8, which is almost purely *E. regnans*, WPC 2.4 is a mixed forest of *E. obliqua*, *E. cypellocarpa* and *E. regnans*.

Most sites have a high cover of *Tetrarrhena juncea* and a disturbed ground layer and show evidence of logging in the past.





WET SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 2.5

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Acacia obliquinervia	94	1	Zieria arborescens	75	1	Viola hederacea	56	+
Polyscias sambucifolius	88	1	Pteridium esculentum	75	1	Eucalyptus obliqua	56	1
Tetrarrhena juncea	88	3	Blechnum wattsii	69	1	Platylobium formosum	56	1
Eucalyptus regnans	81	2	Correa lawrenciana	63	2	Pomaderris aspera	56	2
Alsophila australis	81	1	Gahnia sieberiana	63	1	Prostanthera lasianthos	56	1
Phebalium bilobum	81	1	Acacia dealbata	63	1			

NO. OF SITES: 16 (1.57% of total)

DISTRIBUTION: Restricted to the ranges in the far north of the Study Area, north-east of Mt. Beenak.

ENVIRONMENT: Highest altitude protected slopes. Median annual rainfall is greater than 1300 mm.

ALTITUDE: Mean = 488 m, Highest = 760 m, Lowest = 198 m.

STRUCTURE: Tall open-forest

MEAN FLORISTIC RICHNESS: 21 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: A higher altitude version of WPC 2.4 in which the following species *Correa lawrenciana, Phebalium bilobum, Polyscias sambucifolius, Zieria arborescens, Prostanthera lasianthos* and *Acacia obliquinervia* are more common.

In many of the sites *Tetrarrhena juncea* forms a tangled and sometimes impenetrable ground layer.

This sub-community also has affinities with the higher altitude UYH 8 (Gullan *et al.* 1979).

RIPARIAN FOREST : SUB-COMMUNITY WPC 3.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Alsophila australis	96	1	Acacia melanoxylon	71	1	Goodenia ovata	58	1
Melaleuca squarrosa	92	3	Blechnum minus	71	1	Leptospermum juniperinum	54	1
Blechnum nudum	88	2	Dicksonia antarctica	67	1	Pomaderris aspera	54	1
Tetrarrhena juncea	88	1	Poa tenera	67	1	Viola hederacea	54	1
Carex appressa	79	1	Lepidosperma laterale	63	1	Eucalyptus cypellocarpa	50	1
Gleichenia microphylla	75	2	Coprosma quadrifida	58	1	Blechnum wattsii	50	1
Gahnia sieberiana	75	1	Eucalyptus obliqua	58	1	Olearia lirata	50	1

NO. OF SITES: 24 (2.36% of total)

DISTRIBUTION: Occurring in the ranges in the north of the Study Area.

ENVIRONMENT: Sheltered boggy depressions or close to creeks and rivers in the foothills to the north of the Study Area. Median annual rainfall is 1100-1300 mm.

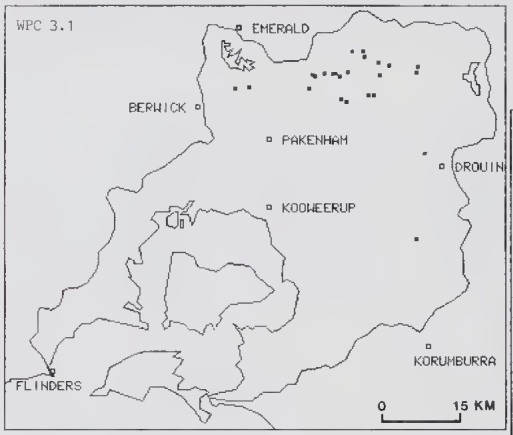
ALTITUDE: Mean = 137 m, Highest = 245 m, Lowest = 85 m.

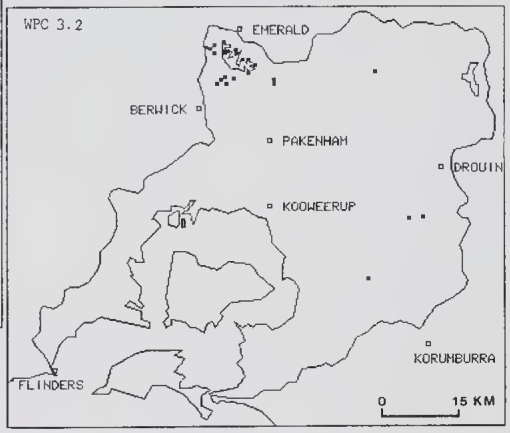
STRUCTURE: Closed-forest to low woodland

MEAN FLORISTIC RICHNESS: 32 species per site. MEAN WEED COMPOSITION: 4% of species, 3% of cover.

NOTES: This riparian sub-community is characterised by a number of species which are typical of swampy ground e.g. *Carex appressa, Gahnia sieberiana* and *Gleichenia microphylla*.

It has floristic affinities with Wet Sclerophyll Forest (Community 2) and also with WPC 3.2 which is found on less swampy creeks.





RIPARIAN FOREST : SUB-COMMUNITY WPC 3.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Tetrarrhena juncea	96	1	Cassinia aculeata	69	1	Hydrocotyle hirta	58	+
Pteridium esculentum	88	1	Helichrysum dendroideum	69	1	Oxalis corniculata	58	+
Eucalyptus obliqua	85	1	Blechnum nudum	69	1	Viola hederacea	58	+
Goodenia ovata	81	1	Lepidosperma laterale	65	1	Eucalyptus ovata	58	1
Acacia verticillata	81	1	Gonocarpus tetragynus	65	1	Gahnia radula	50	1
Acaena anserinifolia	77	1	Gahnia sieberiana	65	1	Blechnum minus	50	1
Leptospermum juniperinum	73	1	Poa tenera	65	1	Culcita dubia	50	1
Rubus fruticosus spp. agg.	73	1	Alsophila australis	65	1	Acacia melanoxylon	50	1
Poa australis spp. agg.	69	1	Carex appressa	62	1			

NO. OF SITES: 26 (2.6% of total)

DISTRIBUTION: Restricted to the low hills in the north-west of the Study Area in the vicinity of Cardinia Reservoir, with a few scattered occurrences in the hills to the east.

ENVIRONMENT: Sheltered lowland gullies or broad shallow rivers which may be silted up to some extent to produce a swampy or very slowly flowing body of water. Median annual rainfall 1000-1100 mm.

ALTITUDE: Mean = 164 m, Highest = 260 m, Lowest = 100 m.

STRUCTURE: Low open-forest to woodland

MEAN FLORISTIC RICHNESS: 42 species per site. MEAN WEED COMPOSITION: 10% of species, 8% of cover.

NOTES: This sub-community, along with WPC 4.1, has the highest values for mean weed composition of all sub-communities north of the Princes Highway. This is a result of its close association with farming activities. The slow moving water bodies of these sites act as sinks for weeds, e.g. *Holcus lanatus* and *Rubus fruticosus* which are carried by water draining directly off farmland near the site and by water carried downstream from farms or picnic areas further away.

Most trees in this sub-community are young.

RIPARIAN FOREST : SUB-COMMUNITY WPC 3.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Acacia melanoxylon	100	1	Rubus parvifolius	86	1	Leptospermum juniperinum	57	1
Acaena anserinifolia	100	1	Scirpus inundatus	71	1	Leptospermum lanigerum	57	3
Carex appressa	100	2	Juncus spp.	71	+	Lobelia alata	57	+
Eucalyptus ovata	100	2	Coprosma quadrifida	71	1	Melaleuca squarrosa	57	1
Poa tenera	100	2	Geranium solanderi	71	1	Polygonum strigosum	57	1
Acacia dealbata	86	1	Phragmites australis	57	2	Dianella tasmanica	57	+
Blechnum nudum	86	1	Gynatrix pulchella	57	+	*Hypochoeris radicata	57	+
Cyperus lucidus	86	2	Hypolepis muelleri	57	1	Lepidosperma laterale	57	2
Gahnia sieberiana	86	1	Alsophila australis	57	+	Pteridium esculentum	57	1
Oxalis corniculata	86	+	Gleichenia microphylla	57	+	Polyscias sambucifolius	57	1
Pomaderris aspera	86	1	Gratiola peruviana	57	1			

NO. OF SITES: 7 (0.69% of total)

DISTRIBUTION: Found along Diamond Creek in the north of the Study Area, with a single occurrence on Back Creek and Labertouche Creek.

ENVIRONMENT: Low altitude flood plains or similarly wet areas. Median annual rainfall is 1200-1300 mm.

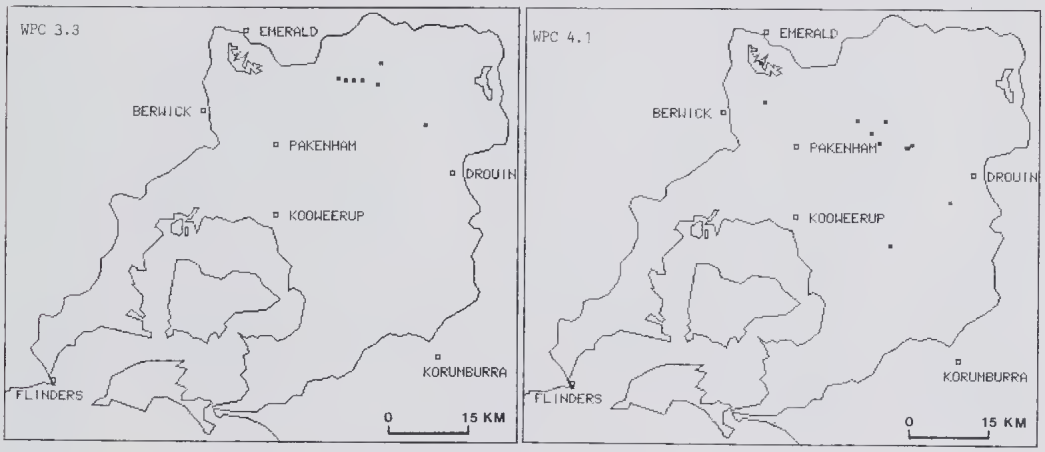
ALTITUDE: Mean = 95 m, Highest = 120 m, Lowest = 60 m.

STRUCTIRE: Tall open-forest to woodland

MEAN FLORISTIC RICHNESS: 36 species per site. MEAN WEED COMPOSITION: 4% of species, 2% of cover.

NOTES: A wide range of plant forms is represented in this sub-community e.g. trees, shrubs, sedges, ferns, grasses, lilies and cryptic and brightly coloured herbs. The majoritiy of these species are small and occupy the ground layer of the vegetation up to 0.5 m.

Gynatrix pulchella, an uncommon riparian shrub, is the only member of the Malvaceae represented in the Study Area.



DRY SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 4.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Glycine clandestina	91	1	Epacris impressa	73	1	Eucalyptus obliqua	64	2
Pteridium esculentum	91	1	Lomandra filiformis	64	1	Eucalyptus radiata	64	2
Viola hederacea	91	1	Acacia stricta	64	1	Hypochoeris radicata	64	1
Microlaena stipoides	82	1	Lomandra longifolia	64	1	Eucalyptus globoidea	55	2
Senecio quadridentatus	82	1	Acianthus exsertus	64	1	Goodenia lanata	55	1
Lagenifera stipitata	73	1	Dichondra repens	64	1	Imperata cylindrica	55	1
Acrotriche prostrata	73	1	Oxalis corniculata	64	1	Lepidosperma laterale	55	+
Adiantum aethiopicum	73	1	Clematis aristata	64	+	Themeda australis	55	2
Poa australis spp. agg.	73	1	Deyeuxia quadriseta	64	1	Pterostylis longifolia	55	+
Gonocarpus tetragynus	73	1	Drosera peltata	64	+	Tetrarrhena juncea	55	2
Cassinia aculeata	73	1						

NO. OF SITES: 11 (1.1% of total)

DISTRIBUTION: Scattered throughout the centre of the Study Area with a small concentration near Garfield and Bunyip.

ENVIRONMENT: Lower altitude dry slopes supporting deep loamy soils, occaisionally with rocky outcrops. Median annual rainfall 900-1100 mm.

ALTITUDE: Mean = 105 m, Highest = 200 m, Lowest = 50 m.

STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 43 species per site. MEAN WEED COMPOSITION: 1% of species, 8% of cover.

NOTES: This sub-community is characterised by a high diversity of types of ground layer species (e.g. climbers, grasses, lilies and herbs) and an abundance of herbs. All sites have been disturbed (grazing, fires, rubbish dumping) WPC 4.1, along with WPC 3.3, has the highest values for mean weed composition of all sub-communities north of the Princes Highway.

Eucalyptus globoidea forms an interesting and localised component of this sub-community. WPC 4.1 is the only sub-community in which *E. globoidea* is a character species and represents the western extremity of this species' range.

DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Tetrarrhena juncea	100	1	Culcita dubia	73	2	Lagenifera stipitata	60	+
Viola hederacea	100	1	Cassinia aculeata	67	1	Blechnum cartilagineum	60	2
Goodenia ovata	93	1	Billardiera scandens	67	+	Centaurium pulchellum	60	+
Poa australis spp. agg.	87	1	Acacia verticillata	67	1	Platylobium formosum	60	1
Pteridium esculentum	87	2	Gahnia radula	67	1	Acrotriche prostrata	53	1
Eucalyptus obliqua	80	2	Helichrysum dendroideum	67	1	Alsophila australis	53	1
Clematis aristata	80	+	Hypochoeris radicata	67	1	Glycine clandestina	53	1
Gonocarpus tetragynus	73	1	Eucalyptus radiata	60	1	Lomandra longifolia	53	+
Leptospermum juniperinum	73	1						

NO. OF SITES: 15 (1.5% of total)

DISTRIBUTION: Contained within a band which stretches east-west across the Study Area and is bounded by the Cardinia Reservoir in the north and the Princes Highway in the south. Most sites are in an area south-west of Tonimbuk but another group is clustered near Officer.

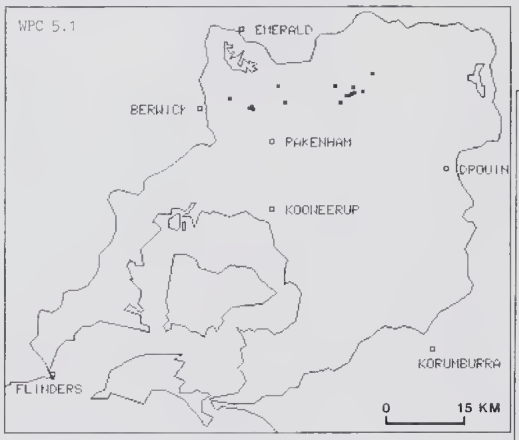
ENVIRONMENT: Riverside slopes and drainage lines in the Damp Sclerophyll Forest of the lowland hills. Median annual rainfall is 90-1200 mm.

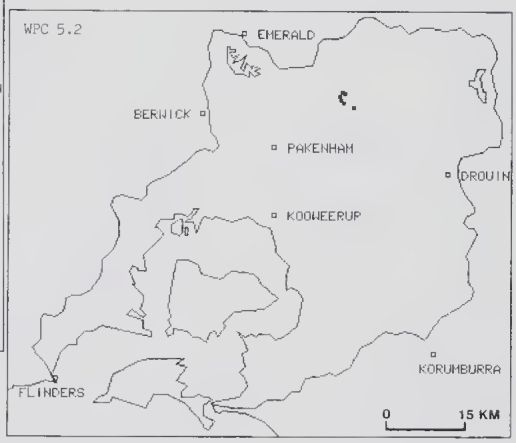
ALTITUDE: Mean = 228 m, Highest = 400 m, Lowest = 100 m.

STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 36 species per site. MEAN WEED COMPOSITION: 6% of species, 5% of cover.

NOTES: Most sites in this sub-community are close to farming areas and consequently support a large number of native species which are considered indicative of disturbances from either road-making, clearing or burning as well as introduced weeds.





DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Epacris impressa	100	1	Helichrysum dendroideum	83	+	Danthonia pilosa	67	1
Leptospermum juniperinum	100	1	Pteridium esculentum	83	1	Lagenifera stipitata	67	1
Poa australis spp. agg.	100	1	Acrotriche prostrata	83	1	Correa reflexa	67	+
Tetrarrhena juncea	100	1	Amperea xiphoclada	83	1	Eucalyptus dives	67	1
Viola hederacea	100	1	Billardiera scandens	83	+	Eucalyptus radiata	67	1
Hypochoeris radicata	100	+	Eucalyptus cypellocarpa	83	1	Gahnia radula	67	1
Eucalyptus obliqua	83	1	Eucalyptus sieberi	83	2	Lomandra longifolia	67	1
Goodenia lanata	83	1	Gnaphalium japonicum	83	+	Pultenaea scabra	67	1
Gonocarpus tetragynus	83	1						

NO. OF SITES: 6 (0.6% of total)

DISTRIBUTION: Restricted to the hills west of Mt. Towt.

ENVIRONMENT: Exposed to cold south-westerly winds. Median annual rainfall is 1100-1200 mm.

ALTITUDE: Mean = 260 m, Highest = 310 m, Lowest = 200 m.

STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 35 species per site. MEAN WEED COMPOSITION: 4% of species, 3% of cover.

NOTES: This sub-community has affinities with the wetter end of the Damp Sclerophyll Forest Community gradient (viz. the occurrence of *Eucalyptus cypellocarpa* and *Helichrysum dendroideum*) and with the Sclerophyll Woodland Community (viz. the occurrence of *Danthonia pilosa*, *Stipa muelleri* and *Lomatia ilicifolia*). The latter occurs at a lower altitude (appproximately 160 m).

WPC 5.2 is characterised by five species of *Eucalyptus*. This is more than any other sub-community in the Study Area.

DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Spyridium parvifolium	96	2	Viola hederacea	83	+	Cassinia aculeata	61	1
Eucalyptus obliqua	96	2	Eucalyptus sieberi	74	1	Clematis aristata	57	1
Tetrarrhena juncea	96	2	Correa reflexa	74	1	Gonocarpus teucrioides	52	+
Goodenia ovata	91	1	Eucalyptus cypellocarpa	74	1	Olearia rugosa	52	1
Pteridium esculentum	91	1	Alsophila australis	70	+	Billardiera scandens	52	+
Lepidosperma elatius	87	1	Bedfordia arborescens	65	1	Olearia lirata	52	1
Platylobium formosum	87	1	Banksia spinulosa	65	1	Pultenaea scabra	52	1
Acacia verticillata	83	1	Eucalyptus baxteri	61	1			

NO. OF SITES: 23 (2.3% of total)

DISTRIBUTION: Mostly on the western end of the ranges in the north of the Study Area, in particular the Black Snake Range.

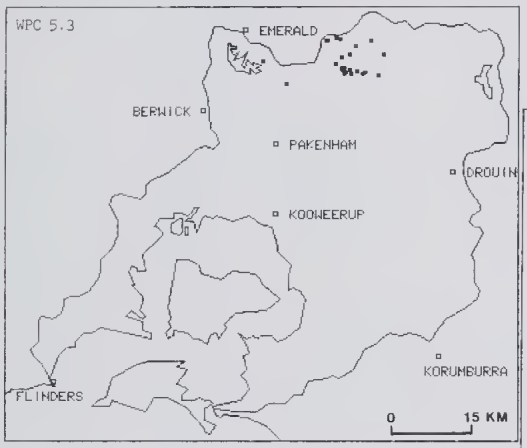
ENVIRONMENT: Sheltered slopes protected from drying winds. Median annual rainfall is 1200-1300 mm.

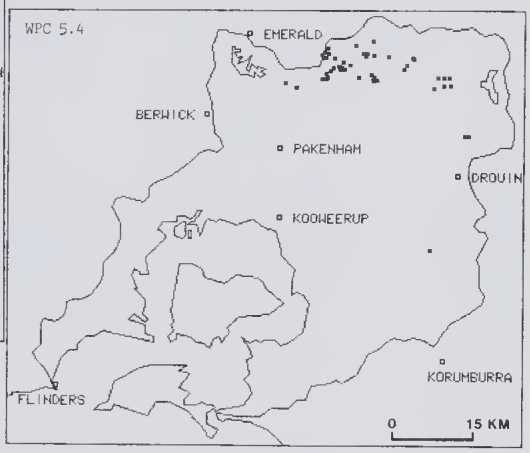
ALTITUDE: Mean = 298 m, Highest = 470 m, Lowest = 120 m.

STRUCTURE: Woodland to open-forest

MEAN FLORISTIC RICHNESS: 27 species per site. MEAN WEED COMPOSITION: 1% of species, 0% of cover.

NOTES: The presence of *Eucalyptus cypellocarpa*, *Bedfordia arborescens* and *Alsophila australis* indicate that this sub-community is a wetter variant of the Damp Sclerophyll Forest Community. The understorey is often a tangled mass of *Spyridium parvifolium*, *Lepidosperma elatius* and *Pteridium esculentum* bound together by *Tetrarrhena juncea*. Large granite rocks are frequently a dominant feature of the site.





DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.4

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Tetrarrhena juncea	96	2	Tetratheca stenocarpa	72	1	Gahnia radula	46	1
Pteridium esculentum	96	1	Eucalyptus obliqua	70	1	Bauera rubioides	46	1
Amperea xiphoclada	93	1	Platylobium formosum	70	1	Pultenaea scabra	43	1
Eucalyptus sieberi	93	2	Leptospermum juniperinum	59	1	Banksia spinulosa	43	1
Spyridium parvifolium	91	2	Billardiera scandens	54	+	Lomatia ilicifolia	39	1
Eucalyptus baxteri	78	2	Pultenaea mollis	52	2	Dampiera stricta	39	+
Correa reflexa	76	1	Lepidosperma elatius	48	1	Olearia rugosa	39	+
Goodenia ovata	74	1	Eucalyptus radiata	48	1	Goodenia lanata	39	1
Viola hederacea	72	1	Acacia oxycedrus	46	1			

NO. OF SITES: 46 (4.5% of total)

DISTRIBUTION: Occurring on the northern slopes of the ranges in the north of the Study Area. Most sites are concentrated at the western end of the Blue Range and Black Snake Range.

ENVIRONMENT: Deep, well-drained loamy soils on hillsides or ridges in the intermediate elevations of the Study Area. Median annual rainfall is 1200-1300 mm.

ALTITUDE: Mean = 275 m, Highest = 510 m, Lowest = 100 m.

STRUCTURE: Woodland to open-forest

MEAN FLORISTIC RICHNESS: 25 species per site MEAN WEED COMPOSITION: No weeds.

NOTES: This sub-community is a drier variant of Damp Sclerophyll Forest than WPC 5.3. It lacks *Eucalyptus cypellocarpa* but has an increased abundance and frequency of *E. sieberi* and *E. baxteri*.

DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.5

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Eucalyptus obliqua	100	2	Viola hederacea	100	1	Eucalyptus cypellocarpa	67	1
Lepidosperma elatius	100	1	Acacia obliquinervia	83	1	Olearia rugosa	67	1
Pteridium esculentum	100	1	Eucalyptus sieberi	83	1	Prostanthera lasianthos	67	+
Tetrarrhena juncea	100	3	Goodenia ovata	83	2	Spyridium parvifolium	67	2

NO. OF SITES: 6 (0.6% of total)

DISTRIBUTION: Scattered throughout the ranges in the north of the Study Area.

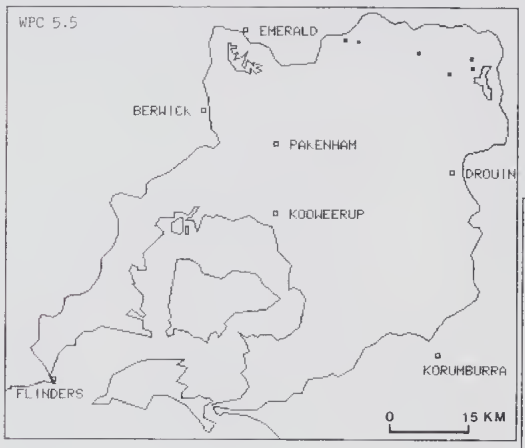
ENVIRONMENT: Well drained hillsides or ridges in the higher elevations of the Study Area. Median annual rainfall is 1200-1300 mm.

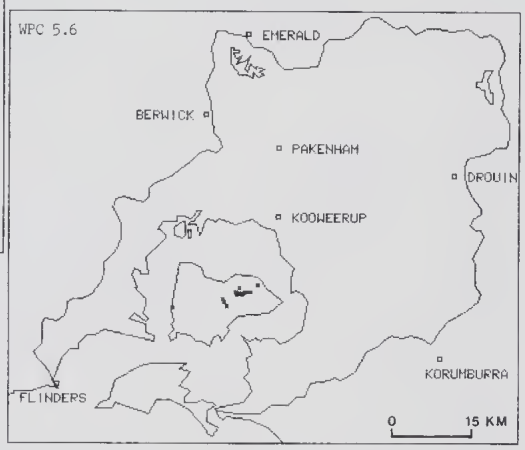
ALTITUDE: Mean = 386 m, Highest = 488 m, Lowest = 228 m.

STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 21 species per site. MEAN WEED COMPOSITION: 1% of species, 1% of cover.

NOTES: This is an unusual sub-community. Its closest affinities are with WPC 5.4 however the occurrence of *Acacia obliquinervia*, and to a lesser extent *Prostanthera lasianthos*, which are typical of higher altitude and higher rainfall areas links this sub-community with WPC 2.5.





DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.6

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Acrotriche serrulata	88	1	Tetrarrhena juncea	88	2	Epacris impressa	69	1
Gahnia radula	88	2	Eucalyptus obliqua	81	2	Hakea sericea	63	1
Gonocarpus teucrioides	88	1	Pteridium esculentum	81	1	Acacia myrtifolia	63	1
Platylobium obtusangulum	88	1	Leptospermum juniperinum	81	2	Billardiera scandens	56	1

NO. OF SITES: 16 (1.6% of total)

DISTRIBUTION: Restricted to the north-east of French Island with an isolated occurrence on the west coast.

ENVIRONMENT: Well-drained hillsides. Median annual rainfall is 800-900 mm.

ALTITUDE Mean = 69 m, Highest = 95 m, Lowest = 10 m.

STRUCTURE: Low open-forest

MEAN FLORISTIC RICHNESS: 21 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: This sub-community has affinities with GLC Community 6. sub-community 1 (Gullan *et al.* 1981) but is a floristically poorer and lower altitude version of it. The understorey consists of species usually regarded as indicative of disturbance (e.g. *Gahnia radula, Platylobium obtusangulum, Pteridium esculentum* and *Tetrarrhena juncea*).

DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.7

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Dichelachne micrantha	100	1	Viola hederacea	100	1	Comesperma volubile	67	1
Dichondra repens	100	1	Agropyron scabrum	67	+	Danthonia racemosa	67	1
Eucalyptus obliqua	100	3	*Anagallis arvensis	67	+	Deyeuxia quadriseta	67	1
Glycine clandestina	100	1	Asperula conferta	67	+	Drosera auriculata	67	+
Helichrysum dendroideum	100	+	Hypericum gramineum	67	+	Gahnia radula	67	1
Lagenifera stipitata	100	+	Pandorea pandorana	67	1	Leptospermum juniperinum	67	1
Microlaena stipoides	100	1	Acacia suaveolens	67	1	Lomandra filiformis	67	+
Oxalis corniculata	100	1	Acaena anserinifolia	67	1	Poa australis spp. agg.	67	1
Pteridium esculentum	100	3	Clematis aristata	67	1	Schoenus apogon	67	1

NO. OF SITES: 3 (0.3% of total)

DISTRIBUTION: Isolated occurrences in the south of French Island.

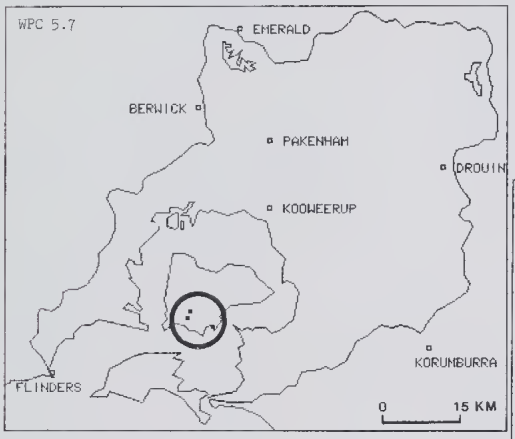
ENVIRONMENT: Well-drained hillsides. Median annual rainfall is less than 800 mm.

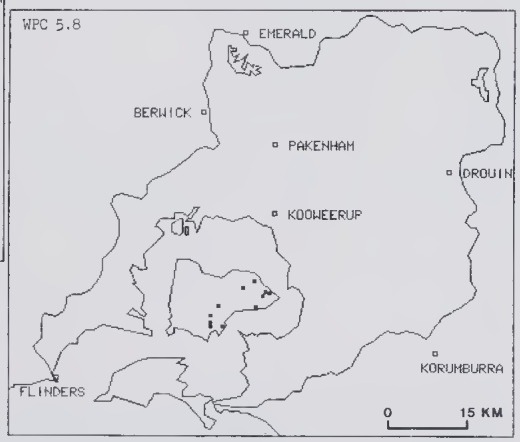
ALTITUDE: Mean = 35 m, Highest = 40 m, Lowest = 25 m.

STRUCTURE: Low open-forest

MEAN FLORISTIC RICHNESS: 38 species per site. MEAN WEED COMPOSITION: 13% of species, 10% of cover.

NOTES: A variant of WPC 5.6 which has a more disturbed and depauperate understorey. The trees (*Eucalyptus obliqua*) have withstood fires in recent years and are amongst the largest of this species on French Island.





DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.8

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Gahnia radula	100	1	Viola hederacea	85	1	Drosera auriculata	62	+
Melaleuca ericifolia	92	2	Billardiera scandens	69	1	Eucalyptus obliqua	62	2
Leptospermum juniperinum	85	1	Pteridium esculentum	69	1	Acacia stricta	54	1
Acacia verticillata	85	1	Dichondra repens	62	1	Microlaena stipoides	54	1

NO. OF SITES: 13 (1.3% of total)

DISTRIBUTION: Scattered throughout the east of French Island.

ENVIRONMENT: Poorly drained freshwater swamps on clayey deposits. Median annual rainfall is between 700 and 900 mm.

ALTITUDE: Mean = 36 m, Highest = 80 m, Lowest = 10 m.

STRUCTURE: Woodland to Tall shrubland

MEAN FLORISTIC RICHNESS: 29 species per site. MEAN WEED COMPOSITION: 6% of species, 4% of cover.

NOTES: Damp Sclerophyll Forest in which *Melaleuca ericifolia* has become a dominant component of the understorey.

M. ericifolia may also be associated, in the same way, with a variety of other communities and eventually exclude most of their other constituent species creating a community of its own viz: *Melaleuca ericifolia* scrub.

DAMP SCLEROPHYLL FOREST : SUB-COMMUNITY WPC 5.9

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Pteridium esculentum	100	3	Poa australis spp. agg.	69	1	Acacia verticillata	62	1
Viola hederacea	100	+	Gonocarpus tetragynus	69	1	Tetrarrhena juncea	62	2
Eucalyptus obliqua	92	3	Oxalis corniculata	69	+	Acaena anserinifolia	54	+
*Hypochoeris radicata	85	+	Acacia stricta	62	1	Eucalyptus radiata	54	1
Clematis aristata	69	+	Helichrysum dendroideum	62	1			

NO. OF SITES: 13 (1.3% of total)

DISTRIBUTION: Restricted to the lowland slopes in the south of the Study Area.

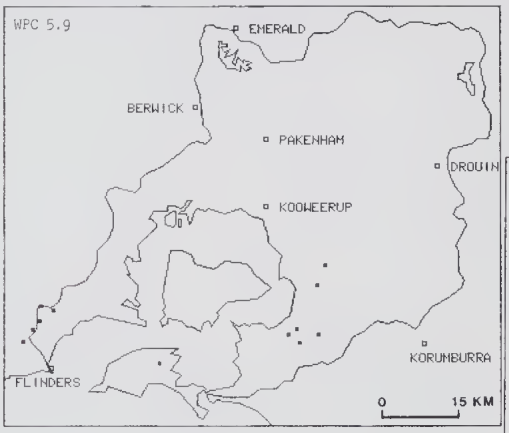
ENVIRONMENT: Clay-loam soils of near-coastal lowland hills. Median annual rainfall is 800-1000 mm.

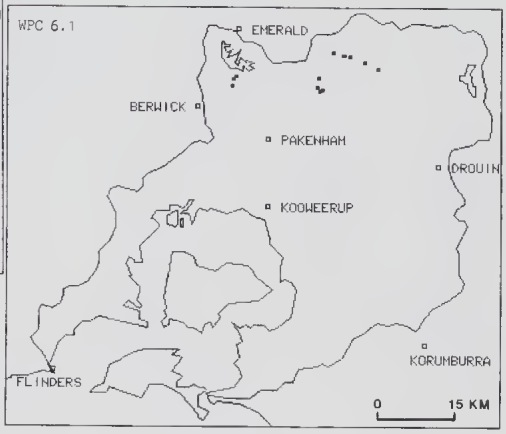
ALTITUDE: Mean = 100 m, Highest = 170 m, Lowest = 30 m.

STRUCTURE: Open-forest to Low woodland

MEAN FLORISTIC RICHNESS: 30 species per site. MEAN WEED COMPOSITION: 6% of species, 4% of cover.

NOTES: This species-poor sub-community has resulted from heavy clearing, burning and grazing pressures. The affinities of WPC 5.9 are obscured by the dominance of *Pteridium esculentum* in the understorey. It most closely represents intermediate to low altitude Damp Sclerophyll Forest.





WET HEATHLAND : SUB-COMMUNITY WPC 6.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Hakea nodosa	100	1	Leptospermum juniperinum	85	1	Epacris obtusifolia	62	1
Empodisma minus	92	1	Gleichenia dicarpa	77	2	Eucalyptus cephalocarpa	62	1
Leptospermum lanigerum	92	1	Xyris operculata	77	2	Lepidosperma filiforme	62	1
Baumea tetragona	92	1	Gahnia sieberiana	77	1	Baumea rubiginosa	54	1
Sprengelia incarnata	92	1	Tetraria capillaris	69	1	Gonocarpus tetragynus	54	+
Melaleuca squarrosa	92	2	Patersonia fragilis	62	1	Lepidosperma forsythii	54	1

NO. OF SITES: 13 (1.3% of total)

DISTRIBUTION: Associated with three of the river systems in the north of the Study Area: (i) Stony Creek, north of Beaconsfield, (ii) headwaters of Cannibal Creek, north of Mary Knoll, and (iii) tributaries of Back Creek.

ENVIRONMENT: Areas of impeded drainage, usually on sandy-clay soils which are often water-logged. Median annual rainfall is 1000-1300 mm.

ALTITUDE: Mean = 135 m, Highest = 190 m, Lowest = 60 m.

STRUCTURE: Open-scrub to low shrubland

MEAN FLORISTIC RICHNESS: 31 species per site. MEAN WEED COMPOSITION: 2% of species, 2% of cover.

NOTES: The most floristically rich wetland vegetation of the Western Port Catchment. Unlike many other wetlands which are dominated by the Cyperaceae or Myrtaceae, WPC 6.1 supports a range of brightly flowered epacrids, irids and lilies.

Lepidosperma forsythii, an uncommon Victorian sedge, is a character species of this sub-community. It is found nowhere else in the Study Area and its next nearest locality is over 100 km away.

Another character species, *Eucalyptus cephalocarpa*, never has a cover value high enough to warrant classifying the vegetation as a woodland.

WET HEATHLAND : SUB-COMMUNITY WPC 6.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Leptospermum juniperinum	100	2	Empodisma minus	80	1	Selaginella uliginosa	60	1
Melaleuca squarrosa	93	2	Gahnia radula	80	1	Bauera rubioides	53	1
Eucalyptus cephalocarpa	87	1	Eucalyptus radiata	73	1	Lindsaea linearis	53	1
Hakea nodosa	87	1	Gonocarpus tetragynus	73	1	Xanthosia dissecta	53	+
Stipa muelleri	87	2	Hakea teretifolia	60	1			

NO. OF SITES: 15 (1.5% of total)

DISTRIBUTION: Mostly restricted to the valleys associated with the northern highlands of the Study Area.

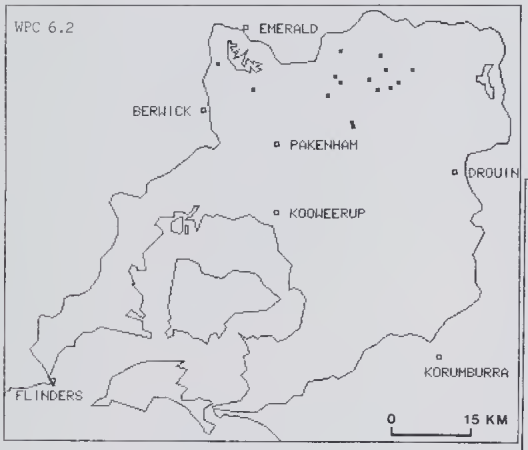
ENVIRONMENT: Clay soils which are often wet. Median annual rainfall is 1200-1300 mm.

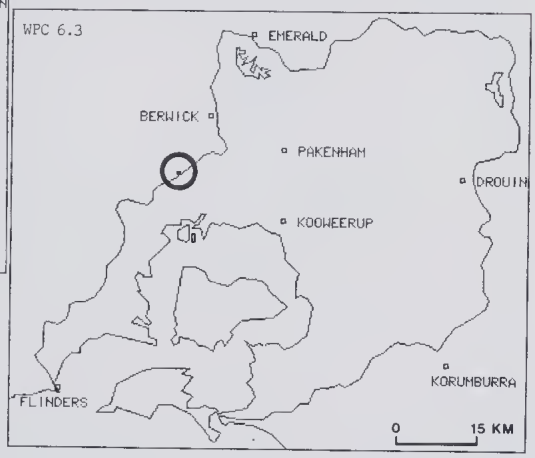
ALTITUDE: Mean = 118 m, Highest = 190 m, Lowest = 70m.

STRUCTURE: Open-forest to Woodland

MEAN FLORISTIC RICHNESS: 37 species per site. MEAN WEED COMPOSITION: 4% of species, 3% of cover.

NOTES: Intermediate in floristic composition between WPC 6.1 and WPC 7.2 and consequently supports species characteristic of both.





WET HEATHLAND : SUB-COMMUNITY WPC 6.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Empodisma minus	100	2	Gahnia sieberiana	100	1	Baumea tetragona	100	2
Cassytha glabella	100	+	Lepidosperma longitudinale	100	1	Melaleuca squarrosa	100	3
Eucalyptus cephalocarpa	100	2	Leptospermum juniperinum	100	2	Schoenus brevifolius	100	1

NO. OF SITES: 1 (0.1% of total)

DISTRIBUTION: Occurs at Cranbourne and surrounds.

ENVIRONMENT: Grows in wet depressions in low nutrient sandy soils in which the drainage is impeded by an underlying layer of clay or coffee rock. Median annual rainfall is approximately 800 mm.

ALTITUDE: All 70 m.

STRUCTURE: Open-scrub

MEAN FLORISTIC RICHNESS: 9 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: The tree layer of this sub-community is sparse. *Melaleuca squarrosa* and *Leptospermum juniperinum* dominate the shrub layer and form dense thickets up to 7 m high. This is in contrast to the form *Melaleuca squarrosa* on the higher nutrient soils of the ranges in the north of the Study Area. For example, in WPC 3.1 *M. squarrosa* may reach heights of 10 m and have a trunk diameter of 0.3 m at standard breast height.

The ground layer of WPC 6.3 is dominated by sedges

This sub-community corresponds to Group 6 Community 2 described by Gullan (1978).

WPC 6.3 also has affinities with the Coastal Heathland of WPC 15.4.

SCLEROPHYLL WOODLAND : SUB-COMMUNITY WPC 7.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Stipa muelleri	96	3	Banksia spinulosa	73	1	Lomandra longifolia	56	1
Tetrarrhena juncea	89	1	Amperea xiphoclada	71	1	Pultenaea gunnii	53	1
Pteridium esculentum	89	1	Acrotriche prostrata	69	1	Poa australis spp. agg.	49	1
Gahnia radula	87	1	Spyridium parvifolium	69	1	Acacia myrtifolia	49	1
Leptospermum juniperinum	80	1	Eucalyptus sieberi	67	1	Hakea ulicina	47	1
Lomandra filiformis	80	1	Lomatia ilicifolia	64	1	Banksia marginata	47	1
Goodenia lanata	78	1	Eucalyptus obliqua	64	2	Pultenaea scabra	44	1
Conocarpus tetragynus	78	1	Eucalyptus radiata	64	1	Dianella caerulea	42	+
Lepidosperma laterale	78	1	Billardiera scandens	64	+	Lindsaea linearis	40	1
Viola hederacea	76	1	Epacris impressa	64	1	Dampiera stricta	40	1
Hakea sericea	73	1	Eucalyptus baxteri	56	1	Xanthorrhoea minor	38	+

NO. OF SITES: 45 (4.4% of total)

DISTRIBUTION: Restricted to the lower slopes of highlands in the north of the Study Area.

ENVIRONMENT: Undulating country or loamy to sandy loam soils with good drainage. Often on southern or eastern aspects of the hills. Median annual rainfall is 1100-1300 mm.

ALTITUDE: Mean = 177 m, Highest = 350 m, Lowest = 80 m.

STRUCTURE: Open-forest

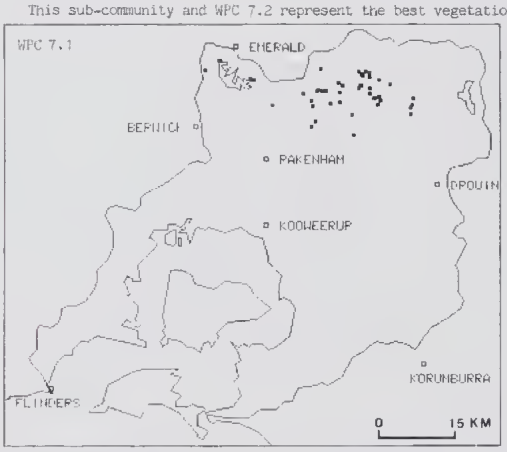
MEAN FLORISTIC RICHNESS: 34 species per site. MEAN WEED COMPOSITION: 1% of species, 1% of cover.

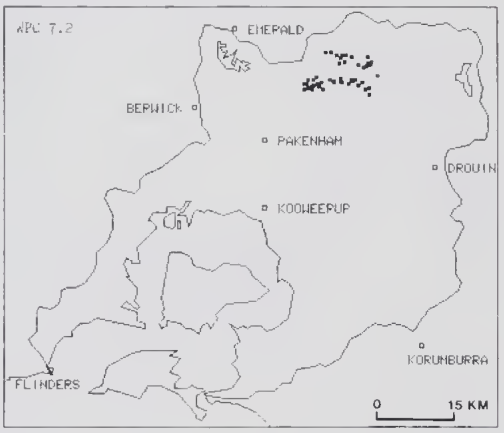
NOTES: The tallest vegetation of Community 7 and has accordingly been exploited for timber: *Eucalyptus obliqua*, *E. sieberi* and *E. baxteri* being the principal sawlog species.

The high *Stipa muelleri* values may be related to a high fire frequency as this species responds well to burning.

WPC 7.1 lacks many of the heathland species common in other Community 7 vegetation and instead supports some species which are characteristic of many Damp Sclerophyll Forests e.g. *Spyridium parvifolium*, *Viola hederacea* and *Billardiera scandens*.

This sub-community and WPC 7.2 represent the best vegetation in the State for *Banksia spinulosa*.





SCLEROPHYLL WOODLAND : SUB-COMMUNITY WPC 7.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Stipa muelleri	100	4	Eucalyptus cephalocarpa	80	1	Lomandra filiformis	61	1
Eucalyptus dives	96	2	Caustis pentandra	76	1	Amperea xiphoclada	59	1
Hakea sericea	96	2	Lepidosperma laterale	76	1	Goodenia lanata	59	+
Hovea heterophylla	89	1	Leptospermum juniperinum	76	1	Gompholobium huegelii	50	+
Dampiera stricta	87	1	Monotoca scoparia	74	1	Persoonia juniperina	46	+
Gahnia radula	87	1	Hakea ulicina	70	1	Tetrarrhena juncea	43	1
Epacris impressa	85	1	Pultenaea gunnii	70	1	Acrotriche prostrata	43	+
Banksia marginata	85	1	Leptospermum myrsinoides	70	1	Acrotriche serrulata	43	1
Conocarpus tetragynus	85	+	Lomatia ilicifolia	67	1	Burchardia umbellata	41	+
Xanthorrhoea minor	83	1	Cassytha glabella	63	+	Acacia oxycedrus	39	1
Banksia spinulosa	80	1						

NO. OF SITES: 46 (4.5% of total)

DISTRIBUTION: Restricted to the northern slopes of the Mt. Towt range and the Black Snake Range in the north of the Study Area.

ENVIRONMENT: Sandy-clay soils on undulating lowlands subject to north-westerly winds. Median annual rainfall is 1100-1300 mm.

ALTITUDE: Mean =151 m, Highest = 300 m, Lowest = 80 m.

STRUCTURE: Low open-forest to Woodland

MEAN FLORISTIC RICHNESS: 33 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: The high cover values of *Stipa muelleri* are probably a result of the frequent fires suffered by this sub-community.

WPC 7.2 and WPC 7.1 represent the best vegetation in the State for *Banksia spinulosa*.

The dominance of members of the Proteaceae, Gramineae and Cyperaceae make this vegetation particularly significant for granivorous and nectivorous animals (e.g. finches and honeyeaters).

SCLEROPHYLL WOODLAND : SUB-COMMUNITY WPC 7.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Gonocarpus tetragynus	96	1	Cassinia aculeata	65	1	Hakea nodosa	45	1
Leptospermum juniperinum	96	1	Eucalyptus radiata	62	1	Lindsaea linearis	45	+
Gahnia radula	95	1	Acacia myrtifolia	60	1	Helichrysum scorpioides	45	+
Eucalyptus cephalocarpa	87	1	Amyema pendulum	58	1	Gompholobium huegelii	44	+
Epacris impressa	85	1	Themeda australis	56	1	Xanthorrhoea minor	42	+
Platylobium obtusangulum	84	1	Billardiera scandens	56	+	Anthoxanthum odoratum	40	1
Banksia marginata	78	1	Microlaena stipoides	56	+	Centaurium pulchellum	40	+
Stipa muelleri	78	3	Hypochoeris radicata	55	+	Burchardia umbellata	40	+
Acrotriche serrulata	76	1	Eucalyptus obliqua	53	1	Lomandra filiformis	40	+
Deyeuxia quadriseta	75	1	Leptospermum myrsinoides	53	1	Goodenia lanata	40	1
Acrotriche prostrata	73	1	Pultenaea gunnii	53	1	Drosera auriculata	38	+
Hakea ulicina	73	1	Lepidosperma laterale	53	1	Lomandra longifolia	38	+
Poa australis spp. agg.	67	1	Danthonia pallida	47	1	Danthonia pilosa	36	1
Hibbertia stricta	65	1	Casuarina paludosa	45	1	Hypericum gramineum	36	+

NO. OF SITES: 55 (5.4% of total)

DISTRIBUTION: Clustered in and around the catchment of the Cardinia Reservoir.

ENVIRONMENT: Clay-loam soils on undulating lowlands south of the Dandenong Ranges. Median annual rainfall is 1000-1100 mm.

ALTITUDE: Mean = 170 m, Highest = 250 m, Lowest = 70 m.

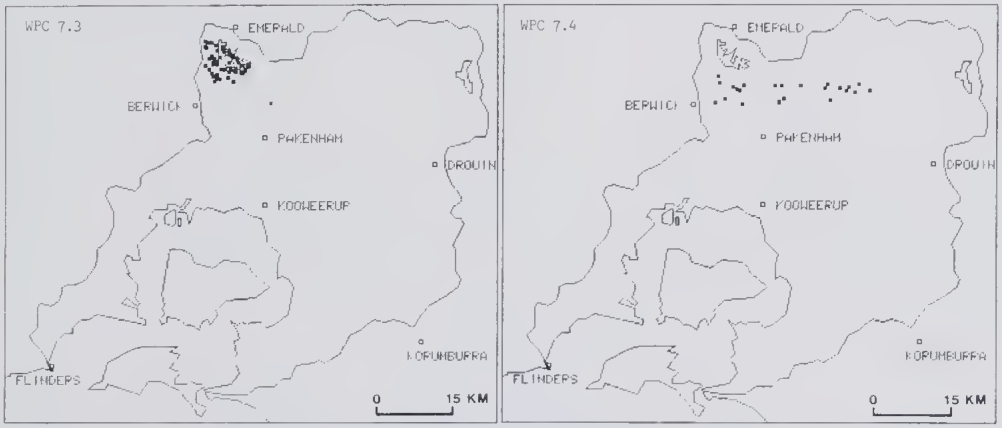
STRUCTURE: Low-woodland

MEAN FLORISTIC RICHNESS: 41 species per site. MEAN WEED COMPOSITION: 6% of species, 5% of cover.

NOTES: Much of the land associated with this vegetation is partially improved pasture with the consequence that introduced grasses and herbs are a common component of its flora.

The greater nutrient status of the soils of WPC 7.3, compared with WPC 7.2, has resulted in an abundance of grasses and herbs in the understorey of the former in place of the sclerophyllous species of the latter. Of particular significance is the abundance of *Themeda australis* (Kangaroo Grass) in areas not completely dominated by *Stipa muelleri*.

The high cover values of *Stipa muelleri* are probably a result of the frequent fires suffered by this sub-community.



SCLEROPHYLL WOODLAND : SUB-COMMUNITY WPC 7.4

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Gahnia radula	92	1	Deyeuxia quadriseta	71	+	Lomandra filiformis	58	1
Gonocarpus tetragynus	92	1	Goodenia lanata	71	+	Billardiera scandens	58	+
Leptospermum juniperinum	92	1	Banksia marginata	67	1	Burchardia umbellata	58	+
Eucalyptus obliqua	83	2	Epacris impressa	67	1	Pultenaea gunnii	54	1
Acrotriche prostrata	83	1	Eucalyptus radiata	63	1	Helichrysum scorpioides	50	1
Poa australis spp. agg.	79	1	Acrotriche serrulata	63	+	Danthonia pallida	50	2
Stipa muelleri	79	3	Lepidosperma laterale	63	1	Dipodium punctatum	50	+
Pteridium esculentum	79	1	Xanthorrhoea minor	63	+	Hakea sericea	50	1
Hypochoeris radicata	71	+						

NO. OF SITES: 27 (2.7% of total.

DISTRIBUTION: Contained within a band which stretches east-west across the Study Area and is bounded by the Cardinia Reservoir in the north and the Princes Highway in the south.

ENVIRONMENT: Clay-loam soils on undulating country south of Central Highlands. Median annual rainfall is 1000-1200 mm.

ALTITUDE: Mean = [illegible] m, Highest = 410 m, Lowest = 40 m.

STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 39 species per site. MEAN WEED COMPOSITION: 6% of species, 4% of cover.

NOTES: This sub-community is floristically very similar to WPC 7.3 and the differences between them may be related to their histories rather than environmental features. For example, in WPC 7.4 *Stipa muelleri* dominates the understorey at the expense of *Themeda australis*, probably as a result of frequent fires. In contrast, the introduced grasses and herbs, common in WPC 7.3, are absent from WPC 7.4 because of the neglible pasture improvement associated with the latter.

SCLEROPHYLL WOODLAND : SUB-COMMUNITY WPC 7.5

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Epacris impressa	100	1	Billardiera scandens	80	+	Eucalyptus dives	70	1
Eucalyptus goniocalyx	100	1	Danthonia pallida	80	2	Lomandra filiformis	70	1
Hypericum gramineum	100	+	Viola hederacea	80	1	Microlaena stipoides	70	+
Poa australis spp. agg.	90	2	Gonocarpus tetragynus	70	1	Burchardia umbellata	60	+
Acrotriche prostrata	90	1	Helichrysum scorpioides	70	1	Acacia stricta	60	1
Deyeuxia quadriseta	90	1	Leptospermum juniperinum	70	1	Eucalyptus obliqua	60	1
Dichelachne micrantha	90	+	Stipa nervosa	70	1	Lepidosperma laterale	60	1
Gahnia radula	90	1	Acrotriche serrulata	70	+	Pteridium esculentum	60	1
Themeda australis	90	2	Cassinia aculeata	70	+	Xanthorrhoea minor	60	1

NO. OF SITES: 10 (1.0% of total)

DISTRIBUTION: Restricted to the hills in and around the catchment of Beaconsfield Reservoir.

ENVIRONMENT: Clay soils of exposed, undulating low lands south of the Dandenong Ranges. Median annual rainfall is 1000-1300 mm.

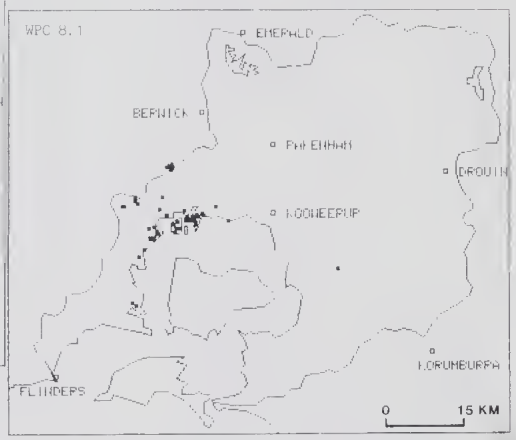
ALTITUDE: Mean = 138 m, Highest = 200 m, Lowest = 80 m.

STRUCTURE: Low open-forest

MEAN FLORISTIC RICHNESS: 44 species per site. MEAN WEED COMPOSITION: 7% of species, 5% of cover.

NOTES: This is the only sub-community of Community 7 which does not have an understorey dominated by *Stipa muelleri* and the only vegetation in the Study Area with *E. goniocalyx* as a character species. Most of the sites supporting this vegetation have been grazed and introduced species are often common. However, deliberate pasture improvement has not usually been effected and the native grasses *Poa australis, Themeda australis* and *Danthonia pallida* always dominate the understorey.

In many places the *E. goniocalyx* appear to be 100 years old or more.



Leptospermum myrsinoides HEATHLAND : SUB-COMMUNITY WPC 8.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Epacris impressa	93	1	Dillwynia glaberrima	65	1	Drosera whittakeri	46	1
Monotoca scoparia	89	1	Banksia marginata	60	1	Cassytha glabella	40	1
Leptospermum myrsinoides	85	3	Leucopogon virgatus	58	1	Bryum billardieri	39	1
Actus ericoides	79	1	Cladonia spp.	57	1	Orchidaceae spp.	38	+
Leptospermum juniperinum	78	2	Campylopus spp.	51	1	Gonocarpus tetragynus	38	1
Eucalyptus viminalis	75	2	Cladia aggregata	47	1			
Amperea xiphoclada	74	1	Hibbertia acicularis	47	1			

NO. OF SITES: 72 (7.1% of total)

DISTRIBUTION: Concentrated on the north-western periphery of the bay with a few scattered occurrences near Crib Point to the south and Lang Lang to the east.

ENVIRONMENT: Flat or undulating near-coastal areas on deep siliceous sands. Median annual rainfall is between 700 and 800 mm.

ALTITUDE: Mean = 17 m, Highest = 100 m, Lowest = sea level.

STRUCTURE: Closed-heath to Open-woodland

MEAN FLORISTIC RICHNESS: 21 species per site. MEAN WEED COMPOSITION: 1% of species (negligible cover).

NOTES: The principle difference between WPC 8.1 and WPC 8.2 is the dominance of *Eucalyptus viminalis* in the former and *E. radiata* in the latter. Other floristic differences are evident, but the change in tree species is the most evident. This variation is probably accounted for by the higher rainfall and cooler temperatures of sites supporting WPC 8.2.

Leptospermum myrsinoides HEATHLAND : SUB-COMMUNITY WPC 8.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Epacris impressa	100	1	Xanthorrhoea minor	59	1	Cladia aggregata	52	1
Leptospermum juniperinum	96	1	Amperea xiphoclada	59	+	Aotus ericoides	52	+
Leptospermum myrsinoides	96	3	Hibbertia acicularis	56	1	Banksia marginata	52	1
Dillwynia glaberrima	78	1	Gahnia radula	56	2	Drosera auriculata	48	+
Monotoca scoparia	70	1	Cassytha glabella	56	+			
Eucalyptus radiata	67	2	Campylopus spp.	56	1			

NO. OF SITES: 28 (2.8% of total)

DISTRIBUTION: Restricted to the western periphery of the bay between Lang Lang and Glen Forbes.

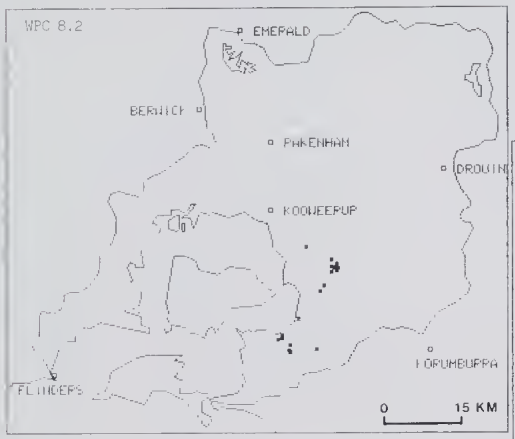
ENVIRONMENT: Flat or undulating near-coastal areas on deep siliceous sands. Median annual rainfall is approximately 900 mm.

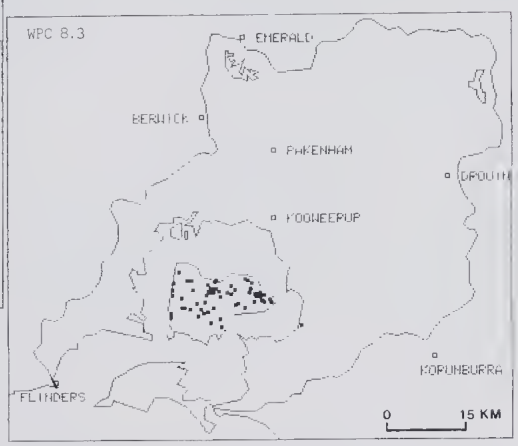
ALTITUDE: Mean = 53 m, Highest = 90 m, Lowest = 20 m.

STRUCTURE: Low woodland

MEAN FLORISTIC RICHNESS: 21 species per site. MEAN WEED COMPOSITION: Negligible

NOTES: WPC 8.2 and WPC 8.1 constitute the eastern and western variants of the same vegetation: the subtle floristic difference between these sub-communities is probably accounted for by the higher rainfall and cooler temperatures of sites supporting WPC 8.2.





Leptospermum myrsinoides HEATHLAND : SUB-COMMUNITY WPC 8.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Epacris impressa	97	1	Acacia suaveolens	66	1	Gahnia radula	55	1
Dillwynia glaberrima	95	1	Gonocarpus teucrioides	64	1	Hypolaena fastigiata	47	2
Leptospermum juniperinum	92	2	Pteridium esculentum	63	1	Drosera auriculata	45	+
Banksia marginata	88	1	Hibbertia acicularis	63	1	Platylobium obtusangulum	42	1
Leptospermum myrsinoides	88	2	Amperea xiphoclada	61	1	Eucalyptus obliqua	41	1
Aotus ericoides	86	1	Cassytha glabella	61	1	Campylopus spp.	39	1
Monotoca scoparia	78	1	Leucopogon virgatus	59	1	Cladia aggregata	36	1
Lepidosperma concavum	75	1	Hibbertia fasciculata	56	1			

NO. OF SITES: 64 (6.2% of total)

DISTRIBUTION: Common on French Is. north of Tankerton and Salt Mine Point roads. One isolated occurrence north-east of Grantville on the mainland.

ENVIRONMENT: Flat or undulating near-coastal areas on sand deeper than that supporting Community 15 and shallower than that supporting WPC 8.1 and WPC 8.2. Median annual rainfall between 700 and 900 mm.

ALTITUDE: Mean = 38 m, Highest = 90 m, Lowest = 5 m.

STRUCTURE: Low open-shrubland

MEAN FLORISTIC RICHNESS: 24 species per site. MEAN WEED COMPOSITION: Negligible

NOTES: This is the commonest vegetation type on French Island. It is consistently floristically richer than WPC 8.1 and WPC 8.2 yet contains appreciable amounts of *Platylobium obtusangulum* and *Pteridium esculentum*, both species indicative of fire disturbance. The canopy layer, generally sparser and lower than either WPC 8.1 and WPC 8.2, usually consists of *Eucalyptus obliqua* or *E. radiata*. Sites which are periodically waterlogged contain wetland species such as *Melaleuca squarrosa* and *Schoenus tenuissimus*.

Leptospermum myrsinoides HEATHLAND : SUB-COMMUNITY WPC 8.4

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Epacris impressa	100	1	Gahnia radula	80	3	Conocarpus tetragynus	80	1
Eucalyptus obliqua	100	2	Cladia aggregata	80	1	Drosera auriculata	60	1
Leptospermum juniperinum	100	2	Cladonia spp.	80	1	Campylopus spp.	60	1
Leptospermum myrsinoides	100	3	Dillwynia glaberrima	80	1			

NO. OF SITES: 5 (0.5% of total)

DISTRIBUTION: Restricted to the area between Queensferry and Corinella on the south-east periphery of the bay.

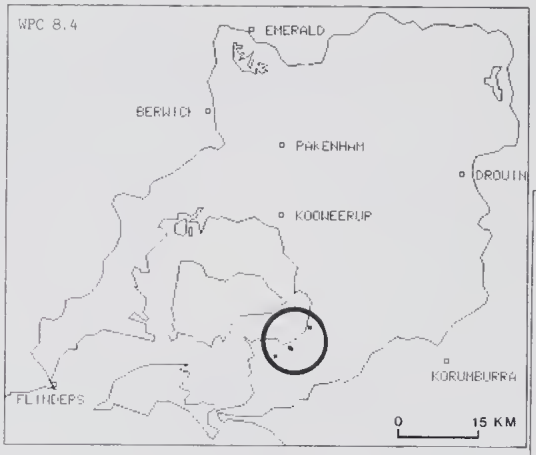
ENVIRONMENT: Flat or undulating near-coastal areas on deep siliceous sands. Median annual rainfall is between 800 and 900 mm.

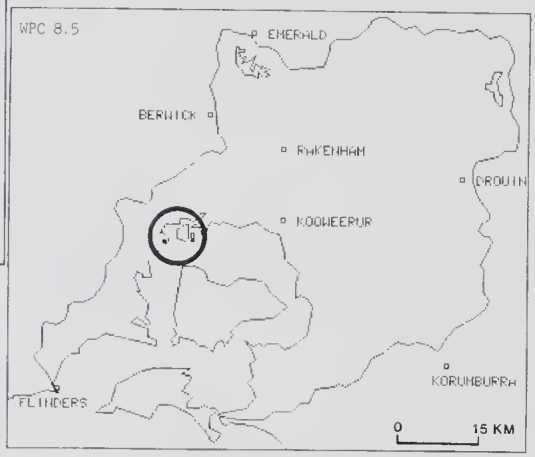
ALTITUDE: Mean = 37 m, Highest = 50 m, Lowest = 5 m.

STRUCTURE: Low woodland

MEAN FLORISTIC RICHNESS: 18 species per site. MEAN WEED COMPOSITION: No weeds

NOTES: A floristically depauperate vegetation with affinities for *Leptospermum myrsinoides* Heathland and Damp Sclerophyll Forest. The low species number and abundance of *Gahnia radula* in the understorey suggest a history of fire disturbance. Most sites showed signs of recent fire.





Leptospermum myrsinoides HEATHLAND : SUB-COMMUNITY WPC 8.5

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Gahnia radula	100	3	Epacris impressa	80	+	Xanthorrhoea minor	60	1
Leptospermum juniperinum	100	2	Eucalyptus viminalis	80	3			

NO. OF SITES: 5 (0.49% of total)

DISTRIBUTION: Restricted to Yaringa and Chinaman Island.

ENVIRONMENT: Flat or undulating areas on deep siliceous sands. Median annual rainfall is 700-800 mm.

ALTITUDE: Mean = 8 m, Highest = 10 m, Lowest = 2 m.

STRUCTURE: Low woodland

MEAN FLORISTIC RICHNESS: 18 species per site. MEAN WEED COMPOSITION: 1% of species, cover is negligible.

NOTES: WPC 8.5 represents a disturbed form of WPC 8.1 most probably in reaction to regular burning and/or grazing. In this case the heath understorey has been replaced by a dense cover of the coarse sedge *Gahnia radula*.

Leptospermum myrsinoides HEATHLAND : SUB-COMMUNITY WPC 8.6

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Pteridium esculentum	93	3	Eucalyptus viminalis	68	2	Epacris impressa	67	+
Leptospermum juniperinum	89	2						

NO. OF SITES: 28 (2.75% of total)

DISTRIBUTION: Dispersed throughout the periphery of the bay and its islands, excluding French Island.

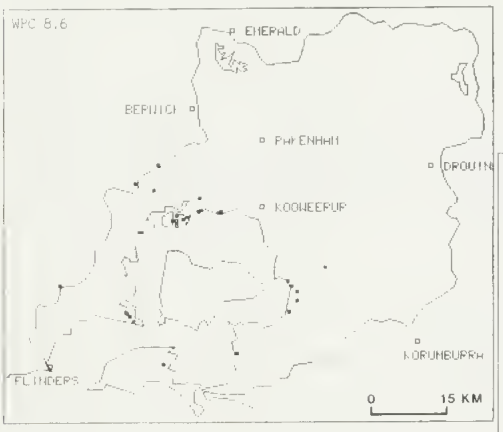
ENVIRONMENT: Flat or undulating areas on deep siliceous sands. Median annual rainfall is between 700 and 800 mm.

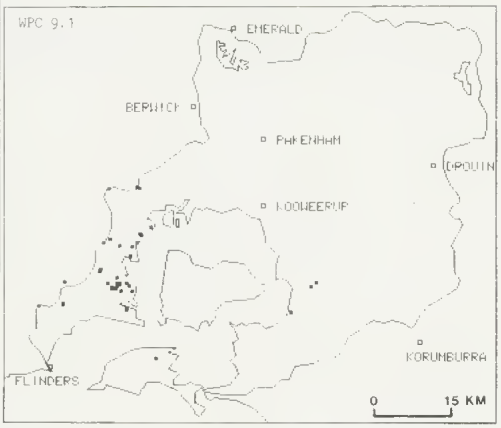
ALTITUDE: Mean = 23 m, Highest = 90 m, Lowest = 2 m.

STRUCTURE: Low woodland to open-forest

MEAN FLORISTIC RICHNESS: 17 species per site. MEAN WEED COMPOSITION: 6% of species, 3% of cover.

NOTES: This large sub-community represents a highly disturbed form of WPC 8.1 and WPC 8.2. Its very low floristic richness and the abundance of bracken (*Pteridium esculentum*) in the understorey is undoubtedly a result of a high fire frequency. Many sites within the catchment belonging to this sub-community were not sampled.





GRASSY WOODLAND : SUB-COMMUNITY WPC 9.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Leptospermum juniperinum	86	2	Epacris impressa	55	1	Poa australis spp. agg.	45	1
Acrotriche serrulata	71	1	Hibbertia stricta	53	1	Eucalyptus obliqua	43	2
Themeda australis	69	2	Lomandra filiformis	51	+	Burchardia umbellata	39	+
Hypericum gramineum	67	1	Xanthorrhoea minor	49	1	Lomandra longifolia	39	1
*Hypochoeris radicata	61	+	Drosera auriculata	47	+	Banksia marginata	39	1
Gahnia radula	59	1	Pteridium esculentum	47	1	Lepidosperma laterale	37	1
Gonocarpus tetragynus	59	1	Eucalyptus radiata	45	2	Viola hederacea	37	1

NO. OF SITES: 49 (4.8% of total)

DISTRIBUTION: Mainly coastal and near-coastal areas to the west of Western Port.

ENVIRONMENT: Flat or undulating inland areas on soils mainly composed of ferruginous sands and sandy clays. Median annual rainfall is 800-900 mm.

ALTITUDE: Mean = 39 m, Highest = 170 m, Lowest = 5 m.

STRUCTURE: Woodland

MEAN FLORISTIC COMPOSITION: 28 species per site. MEAN WEED COMPOSITION: 6% of species, 5% of cover.

NOTES: This sub-community is probably a more disturbed and species-poor version of WPC 9.2 and several of the most abundant species here are indicative of severe disturbance, (e.g. *Pteridium esculentum, Leptospermum juniperinum, Gahnia radula*), particularly from fire and grazing. However, the disturbance may not be as great as is indicated by the floristics. For example, the native grass *Themeda australis* is more abundant in WPC 9.1 than in WPC 9.2. Also the low apparent species richness may be due to the inability of field recorders (e.g. Calder (1974) and Grant (1974)) to identify many grasses, composites and annuals from vegetative parts.

GRASSY WOODLAND : SUB-COMMUNITY WPC 9.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Acrotriche serrulata	100	+	Dichopogon strictus	82	+	Casuarina littoralis	64	1
Drosera auriculata	100	1	Stipa pubescens	82	1	Lomandra longifolia	64	1
Gonocarpus tetragynus	100	1	Tricoryne elatior	82	1	Acacia mearnsii	64	1
*Hypochoeris radicata	100	1	Pteridium esculentum	82	1	*Aira caryophyllea	64	1
Lomandra filiformis	100	1	Poa australis spp. agg.	73	1	Oxalis corniculata	64	+
Themeda australis	100	1	*Anthoxanthum odoratum	73	1	Pimelea humilis	64	+
Leptospermum juniperinum	91	1	Schoenus apogon	73	1	*Holcus lanatus	55	+
Microlaena stipoides	91	1	Viola hederacea	73	+	*Rubus fruticosus spp. agg.	55	1
Poranthera microphylla	91	1	Exocarpos cupressiformis	64	+	Acacia verticillata	55	1
Acacia paradoxa	91	1	*Briza minor	64	+	Billardiera scandens	55	+
Hypericum gramineum	91	1	Acacia melanoxylon	64	1	Epacris impressa	55	1
Hibbertia stricta	82	1	Bossiaea prostrata	64	1	Eucalyptus radiata	55	1
Lepidosperma laterale	82	1	*Briza maxima	64	+	Lagenifera stipitata	55	+
Deyeuxia quadriseta	82	1	Burchardia umbellata	64	1	Pentapogon quadrifidus	55	+

NO. OF SITES: 11 (1.1% of total)

DISTRIBUTION: Mostly coastal and near-coastal areas to the west of Western Port.

ENVIRONMENT: Flat or undulating inland areas on soils mainly composed of ferruginous sands and sandy clays. Median annual rainfall is 800-900 mm.

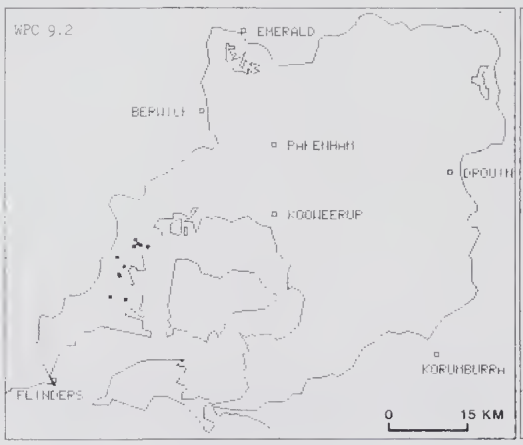
ALTITUDE: Mean = 21 m, Highest = 35 m, Lowest = 5 m.

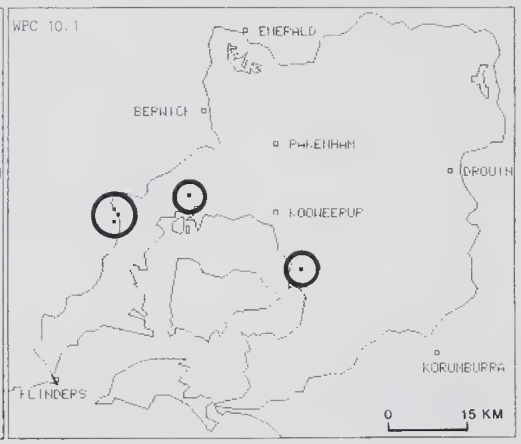
STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 51 species per site. MEAN WEED COMPOSITION: 16% of species, 15% of cover.

NOTES: The sparse canopy is usually made up of one or two of a range of eucalypts with *E. radiata* being the most common. The understorey is dominated by six species of native grass. Five species of introduced grass are also present but, apart from *Anthoxanthum odoratum*, do not displace the native species.

Grazing by domestic stock in many sites has caused a deterioration in the quality and abundance of most shrub layer species. However, stock tend to avoid the spiny shrub, *Acacia paradoxa*, large specimens of which are common throughout the sub-community.





SUB-COMMUNITY WPC 10.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Eucalyptus pauciflora	100	1	Themeda australis	83	2	Lepidosperma laterale	67	2
Gahnia radula	100	1	Casuarina littoralis	83	2	Leptospermum juniperinum	67	1
Gonocarpus tetragynus	100	+	Acacia paradoxa	67	1			

NO. OF SITES: 6 (0.59% of total)

DISTRIBUTION: Restricted to the lowland plains in the south of the Study Area around Western Port.

ENVIRONMENT: Lowland plains. Median annual rainfall is 800 mm or less.

ALTITUDE: Mean = 51 m, Highest = 70 m, Lowest = 15 m.

STRUCTURE: Open-forest

MEAN FLORISTIC RICHNESS: 22 species per site. MEAN WEED COMPOSITION: 5% of species, 2% of cover.

NOTES: The sites in this sub-community are very disturbed remnants of a sub-community that was probably more widespread prior to European settlement. The abundance of *Themeda australis* suggests it was once a woodland with grassy understorey. The major disturbance to this sub-community would have resulted from selective grazing by cattle producing a reduction in the abundance of native grasses and an increased abundance of non-preferred species such as *Acacia paradoxa, Gahnia radula, Lepidosperma laterale* and *Leptospermum juniperinum*.

WPC 10.1 is part of a major disjunction in the distribution of *Eucalyptus pauciflora*. This species most commonly occurs in the alpine or sub-alpine regions of Victoria but also has a number of very isolated lowland occurrences. This sub-community represents the most south-easterly occurrence of the lowland populations in Victoria.

SUB-COMMUNITY WPC 12.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Comesperma volubile	100	1	Eucalyptus viminalis	100	3	Senecio spp.	75	+
Dianella revoluta	100	2	Lomandra longifolia	100	4			

NO. OF SITES: 4 (0.4% of total)

DISTRIBUTION: Restricted to Quail Island and Warneet.

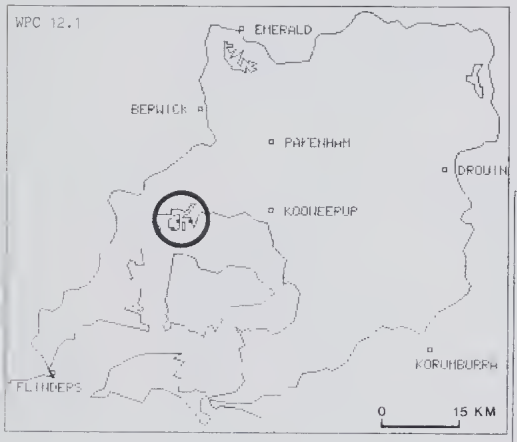
ENVIRONMENT: Flat or undulating areas on deep siliceous sands. Median annual rainfall is between 700 and 800 mm.

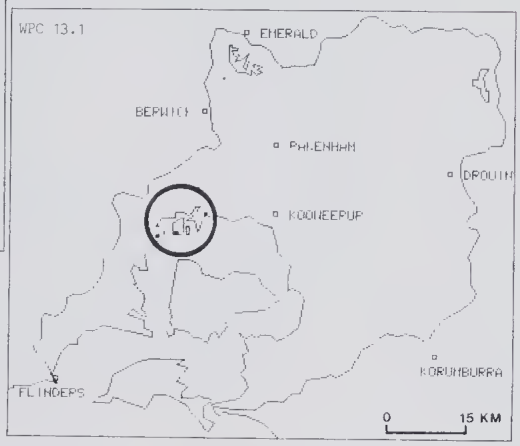
ALTITUDE: All 5 m.

STRUCTURE: Low woodland

MEAN FLORISTIC RICHNESS: 20 species per site. MEAN WEED COMPOSITION: 9% of species, 7% of cover.

NOTES: This low woodland community lacks a shrub layer. The dominance of the ground layer species, *Lomandra longifolia* and *Dianella revoluta*, may be the result of grazing.





Melaleuca ericifolia SCRUB : SUB-COMMUNITY WPC 13.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Cassytha pubescens	100	1	Lepyrodia muelleri	100	1	Epacris impressa	75	+
Gonocarpus tetragynus	100	+	Melaleuca ericifolia	100	4	Eucalyptus viminalis	75	1
*Hypochoeris radicata	100	+	Comesperma volubile	75	+	Gramineae spp.	75	+
Leptospermum juniperinum	100	1	Dichondra repens	75	1			

NO. OF SITES: 4 (0.4% of total)

DISTRIBUTION: Scattered throughout the Study Area.

ENVIRONMENT: Poorly drained fresh water swamps on sandy clays. Median annual rainfall is between 700 and 800 mm.

ALTITUDE: Mean = 4 m, Highest = 5 m, Lowest = 2 m.

STRUCTURE: Closed-scrub

MEAN FLORISTIC RICHNESS: 24 species per site. MEAN WEED COMPOSITION: 8% of species, 5% of cover.

NOTES: Dense thickets of *Melaleuca ericifolia*. The understorey of wet heath species has affinities with WPC 15.6 - the Coastal Heathland.

Melaleuca ericifolia SCRUB : SUB-COMMUNITY WPC 13.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Melaleuca ericifolia	100	3	*Hypochoeris radicata	50	1	Acacia verticillata	47	1

NO. OF SITES: 34 (3.3% of total)

DISTRIBUTION: Occurring on the lowlands around Western Port and on French Island.

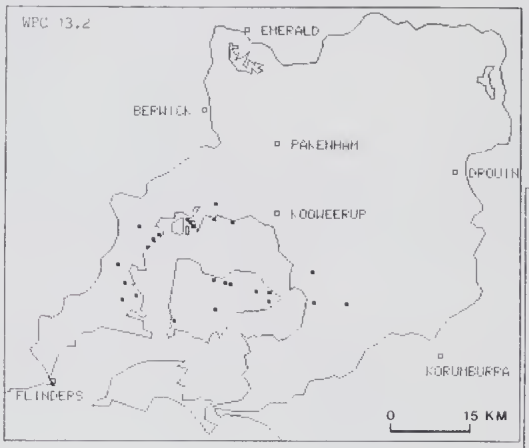
ENVIRONMENT: Freshwater swamps on clayey and peaty deposits. Median annual rainfall is less than 900 mm.

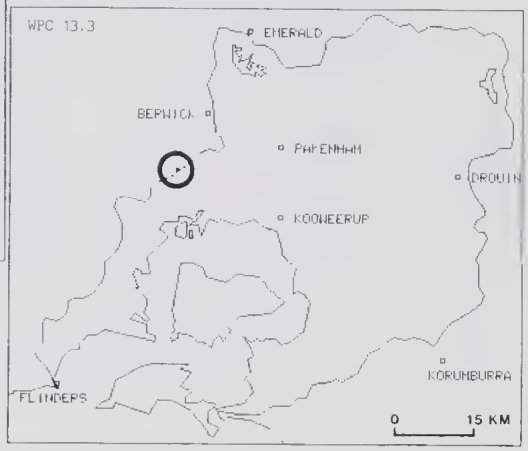
ALTITUDE: Mean = 18 m, Highest = 100 m, Lowest = 1 m.

STRUCTURE: Low woodland to closed-scrub

MEAN FLORISTIC RICHNESS: 20 species per site. MEAN WEED COMPOSITION: 9% of species, 7% of cover.

NOTES: This sub-community represents a disturbed remnant of a previously widespread vegetation type. The dense thickets of *Melaleuca ericifolia* have a variety of understoreys ranging from floristically depauperate sites, in which the ground layer consists only of mosses, to floristically richer sites in which many of the understorey species are shared with the abutting vegetation type.





Melaleuca ericifolia SCRUB : SUB-COMMUNITY WPC 13.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Eucalyptus cephalocarpa	100	1	Lepyrodia muelleri	100	2	Schoenus brevifolius	100	2
Lepidosperma longitudinale	100	2	Melaleuca ericifolia	100	3			
Leptospermum juniperinum	100	1	Poa australis spp. agg.	100	1			

NO. OF SITES: 1 (0.1% of total)

DISTRIBUTION: Occurs at Cranbourne and surrounds.

ENVIRONMENT: Poorly drained clay soils. Median annual rainfall is approximately 800 mm.

ALTITUDE: All 60 m.

STRUCTURE: Open-scrub

MEAN FLORISTIC RICHNESS: 7 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: This vegetation is physiognomically very similar to WPC 6.3 where, due to change from a clay to a sandy soil type, *Melaleuca ericifolia* is replaced by *M. squarrosa* and *Lepyrodia muelleri* is replaced by *Empodisma minus*. The ground layer of WPC 13.3, as for WPC 6.3, is a dense sward of sedges and rushes.

This sub-community corresponds to Group 8 described by Cullan (1978).

Melaleuca ericifolia SCRUB : SUB-COMMUNITY WPC 13.4

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Melaleuca ericifolia	100	3	Samolus repens	55	2	Disphyma clavellatum	50	2
Selliera radicans	59	1						

NO. OF SITES: 22 (5.3% of total)

DISTRIBUTION: Common along the eastern and western shoreline of Western Port.

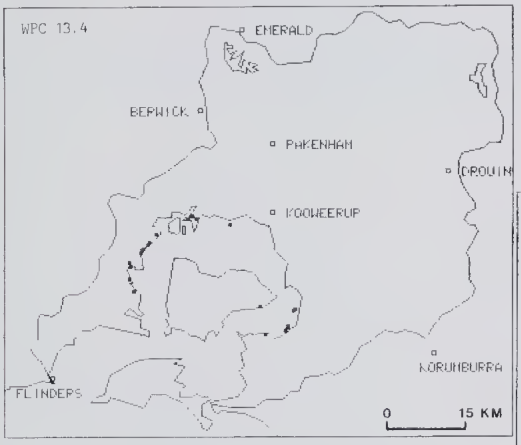
ENVIRONMENT: Areas bordering on salt marsh, beyond the influence of tides except extreme high tides.

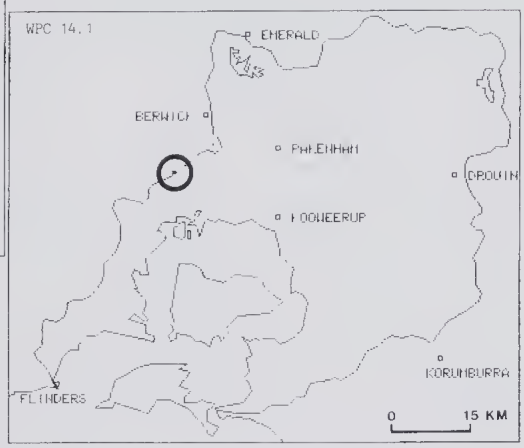
ALTITUDE: Sea level

STRUCTURE: Closed-scrub

MEAN FLORISTIC RICHNESS: 7 species per site. MEAN WEED COMPOSITION: 8% of species, 7% of cover.

NOTES: This sub-community forms a boundary or ecotone between the salt marsh and heathland/woodland communities. Sites are dominated by *Melaleuca ericifolia* with a variety of salt marsh species in the understorey.





SEDGE SWAMPLAND : SUB-COMMUNITY WPC 14.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Eucalyptus cephalocarpa	100	2	Lepidosperma longitudinale	100	1	Schoenus brevifolius	100	5
Eucalyptus viminalis	100	1	Leptospermum juniperinum	100	2			
Hakea ulicina	100	2	Lepyrodia muelleri	100	2			

NO. OF SITES: 1 (0.1% of total)

DISTRIBUTION: Occurs at Cranbourne and surrounds.

ENVIRONMENT: Water-logged sandy soils usually with 10 to 30 cm of standing water throughout the year. Median annual rainfall is approximately 800 mm.

ALTITUDE: All 60 m.

STRUCTURE: Closed-sedgeland

MEAN FLORISTIC RICHNESS: 7 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: The dense, but species-poor, sward of sedges characterising this sub-community is dominated by *Schoenus brevifolius*.

WPC 14.1 corresponds to Group 7 described by Gullan (1978).

SEDGE SWAMPLAND : SUB-COMMUNITY WPC 14.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Gonocarpus micranthus	100	+	Patersonia fragilis	100	2	Cassytha glabella	67	1
Lepidosperma longitudinale	100	1	Schoenus brevifolius	100	2	Patersonia occidentalis	67	1
Leptospermum juniperinum	100	1	Selaginella uliginosa	100	1			

NO. OF SITES: 3 (0.3% of total)

DISTRIBUTION: Scattered in the north-west of French Island.

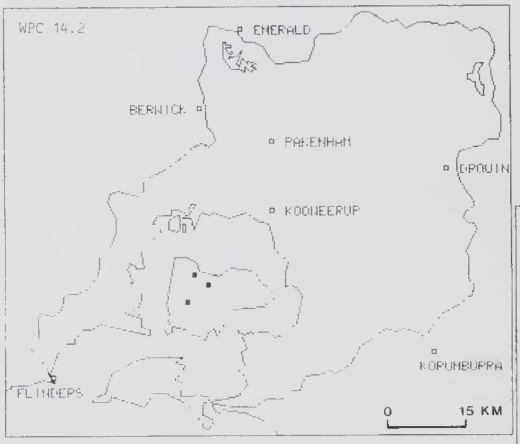
ENVIRONMENT: Near coastal heaths on wet sandy soils. Median annual rainfall is between 700 and 800 mm.

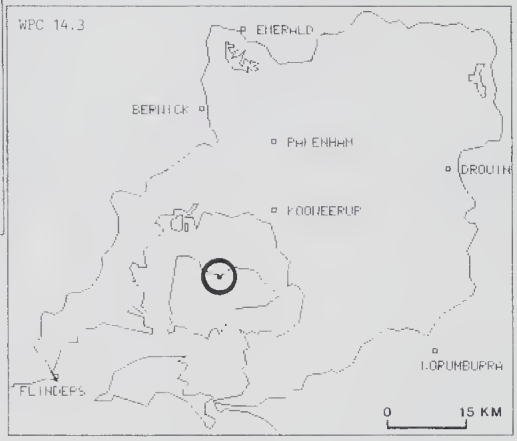
ALTITUDE: Mean = 26 m, Highest = 45 m, Lowest = 10 m.

STRUCTURE: Closed-sedgeland

MEAN FLORISTIC RICHNESS: 14 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: A floristically-richer variant of WPC 14.3. Open-swamp dominated by monocotyledons.





SEDGE SWAMPLAND : SUB-COMMUNITY WPC 14.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Lepidosperma longitudinale	100	3	Sphagnum subsecundum	100	3			

NO. OF SITES: 2 (0.2% of total)

DISTRIBUTION: Two sites, less than 200 m apart, on the north-central coast of French Island.

ENVIRONMENT: Poorly drained fresh water swamp on clayey and sandy deposits. Median annual rainfall is between 700 and 800 mm.

ALTITUDE: All 10 m.

STRUCTURE: Sedgeland

MEAN FLORISTIC RICHNESS: 3 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: A floristically-poor sub-community characterised by species which are able to tolerate water-logged soil conditions.

COASTAL HEATHLAND : SUB-COMMUNITY WPC 15.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Boronia parviflora	100	1	Baumea juncea	100	2	*Cicendia filiformis	67	1
Casuarina pusilla	100	1	Mitrasacme paradoxa	100	+	Gahnia trifida	67	1
Centrolepis aristata	100	+	Caesia parviflora	67	+	Hakea nodosa	67	1
Danthonia setacea	100	1	Lepidosperma longitudinale	67	1	*Leontodon taraxacoides	67	+
Deyeuxia quadriseta	100	1	Schoenus brevifolius	67	2	Olearia ramulosa	67	1
Drosera pygmaea	100	1	Schoenus latelaminatus	67	+	Schoenus apogon	67	1
Entolasia marginata	100	1	Thysanotus tuberosus	67	1	Selliera radicans	67	1
Goodenia humilis	100	1	Aphelia gracilis	67	+	Stylidium beaugleholei	67	+
Leptospermum juniperinum	100	1	Casuarina paludosa	67	1	Stylidium despectum	67	1

NO. OF SITES: 3 (0.3% of total)

DISTRIBUTION: Three isolated occurrences in the western part of French Island.

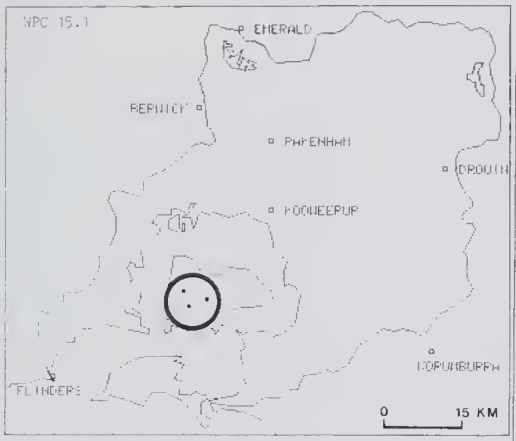
ENVIRONMENT: Ground subject to standing water most of the year but dries out in summer. Median annual rainfall is between 700 and 800 mm.

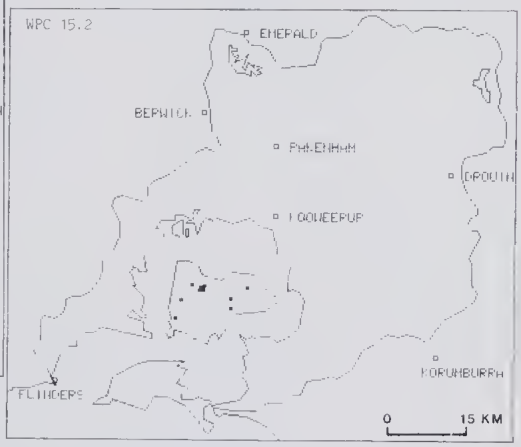
ALTITUDE: Mean = 33 m, Highest = 50 m, Lowest = 15 m.

STRUCTURE: Low shrubland

MEAN FLORISTIC RICHNESS: 39 species per site. MEAN WEED COMPOSITION: 6% of species, 5% of cover.

NOTES: Ground bare between the shrubs and monocotyledinous tussocks, except during summer when it is sparsely covered with large numbers of a range of very small (ca. 3 cm) annuals. Five species of these annuals possess adaptations specific to small insects and form an interesting and important component of this sub-community. They are *Drosera pygmaea* and *Polypompholyx tenella*, which are insectivorous, and *Stylidium beaugleholei*, *S. despectum* and *S. perpusillum* which are trigger plants.





COASTAL HEATHLAND : SUB-COMMUNITY WPC 15.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Casuarina pusilla	100	1	Hibbertia stricta	90	1	Stipa hemipogon	70	1
Gahnia radula	100	2	Platylobium obtusangulum	90	1	Thysanotus tuberosus	70	1
Lepidosperma neesii	100	2	Stypandra caespitosa	90	1	Opercularia varia	60	+
Leptospermum juniperinum	100	2	Viola sieberiana	80	1	Drosera auriculata	60	+
Schoenus brevifolius	100	2	Lindsaea linearis	80	1	Epacris impressa	60	1
Xanthosia pusilla	100	1	Schoenus apogon	70	1	Microlaena stipoides	60	1
Drosera pygmaea	90	1	Caesia parviflora	70	+	Xanthorrhoea minor	60	1
Casuarina paludosa	90	1	Chamaescilla corymbosa	70	1			
Entolasia marginata	90	2	Gonocarpus teucrioides	70	1			

NO. OF SITES: 10 (1.0% of total)

DISTRIBUTION: Scattered throughout French Island with a small concentration in the north-west.

ENVIRONMENT: Shallow siliceous sands or ferruginous sands and clays often waterlogged. Median annual rainfall is between 700 and 900 mm.

ALTITUDE: Mean = 27 m, Highest = 80 m, Lowest = 10 m.

STRUCTURE: Low shrubland to sedgeland

MEAN FLORISTIC RICHNESS: 36 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: An unusually high proportion of monocotyledons are represented in this sub-community. Two of these, *Lepidosperma neesii* and *Entolasia marginata*, uncommon elsewhere in the Western Port Catchment, indicate the strong affinities this sub-community has for East Gippsland coastal heaths. WPC 15.2 is floristically very similar to EG Community 17, sub-community 1 (Forbes *et al.* 1982).

The vegetation of most of these sites is approximately five years old and has recently been subjected to fire and/or grazing.

COASTAL HEATHLAND : SUB-COMMUNITY WPC 15.3

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Casuarina pusilla	100	1	Schoenus brevifolius	80	2	Drosera pygmaea	60	1
Drosera auriculata	100	1	Stypandra caespitosa	80	1	Gahnia radula	60	2
Leptospermum juniperinum	100	2	Caesia parviflora	80	+	Gonocarpus micranthus	60	1
Schoenus tenuissimus	90	1	Platylobium obtusangulum	70	1	Gonocarpus teucrioides	60	1
Dillwynia glaberrima	90	1	Banksia marginata	70	+	Microlaena stipoides	60	1
Opercularia varia	90	+	Empodisma minus	70	1	Selaginella uliginosa	60	1
Casuarina paludosa	80	1	Patersonia fragilis	70	2	Xanthosia dissecta	60	+
Epacris impressa	80	1	Xanthosia pusilla	70	+			

NO. OF SITES: 10 (1.0% of total)

DISTRIBUTION: Scattered throughout French Island.

ENVIRONMENT: Shallow ferruginous, sands overlying ferruginous clays or shallow sands: wetter than WPC 7.2. Median annual rainfall is between 700 and 900 mm.

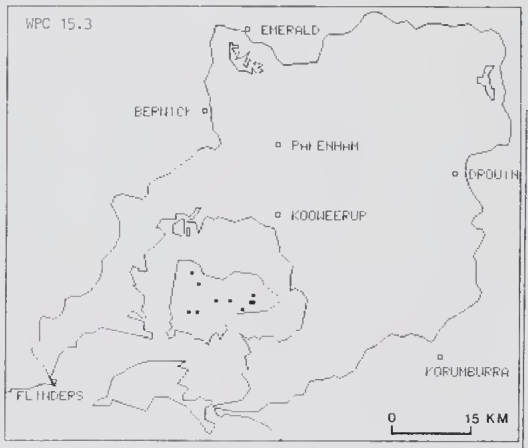
ALTITUDE: Mean = 40 m, Highest = 70 m, Lowest = 10 m.

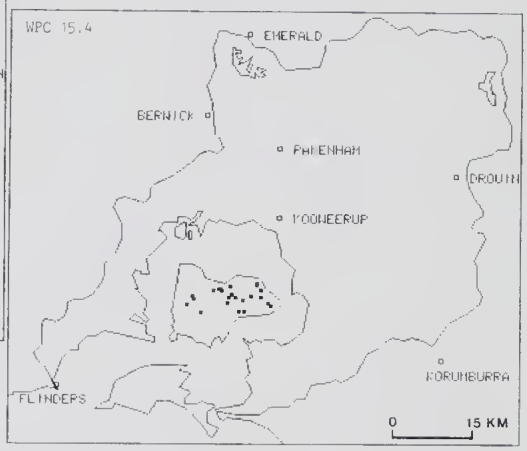
STRUCTURE: Open-heath to sedgeland

MEAN FLORISTIC RICHNESS: 35 species per site. MEAN WEED COMPOSITION: 3% of species, 2% of cover.

NOTES: In this sub-community a group of species restricted to WPC 15.2 is replaced by a group of species adapted to tolerate standing water for long periods. WPC 15.3 represents a transition from the drier WPC 15.2 to the wetter WPC 15.4.

The vegetation of most sites is approximately five to ten years old and is regenerating after being subjected to a variety of disturbances e.g. fire, clearing or grazing.





COASTAL HEATHLAND : SUB-COMMUNITY WPC 15.4

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Leptospermum juniperinum	100	2	Cassytha glabella	79	1	Banksia marginata	54	+
Melaleuca squarrosa	88	2	Gahnia radula	67	2	Bauera rubioides	50	1
Empodisma minus	83	2	Gonocarpus teucrioides	67	1	Drosera auriculata	50	1
Selaginella uliginosa	83	1	Schoenus brevifolius	54	2	Schoenus tenuissimus	50	2
Epacris obtusifolia	79	1	Sprengelia incarnata	54	2			

NO. OF SITES: 24 (2.4% of total)

DISTRIBUTION: Widespread throughout the north of French Island but with the majority of sites located in the north-east.

ENVIRONMENT: Depressions or swamps with shallow sands overlying a clay base. Median annual rainfall is between 700 and 900 mm.

ALTITUDE: Mean = 40 m, Highest = 90 m, Lowest = 10 m.

STRUCTURE: Closed-heath

MEAN FLORISTIC RICHNESS: 23 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: This sub-community shares a large proportion of its species and genera with EG Community 17, sub-community 2 (Forbes *et al.* 1982) which is widely known as "grass-tree plain". On French Island the "grass-tree" *(Xanthorrhoea minor)* does not dominate the sub-community as it does in East Gippsland.

The vegetation of WPC 15.4 ranges from 10 to 30 years old and is older than that in the other sub-communities of WPC Community 15. Some noteable specimens of *Casuarina pusilla* and *Casuarina paludosa* in this coastal heathland were greater than 3 metres tall.

COASTAL HEATHLAND : SUB-COMMUNITY WPC 15.5

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Gonocarpus teucrioides	100	1	Bauera rubioides	65	2	Lindsaea linearis	57	1
Leptospermum juniperinum	100	2	Platylobium obtusangulum	57	1	Lepidosperma filiforme	52	2
Gahnia radula	83	2	Banksia marginata	57	+			
Casuarina paludosa	78	1	Epacris impressa	57	+			

NO. OF SITES: 23 (2.3% of total)

DISTRIBUTION: Concentrated in the north-central region of French Island with a few sites in the north-east.

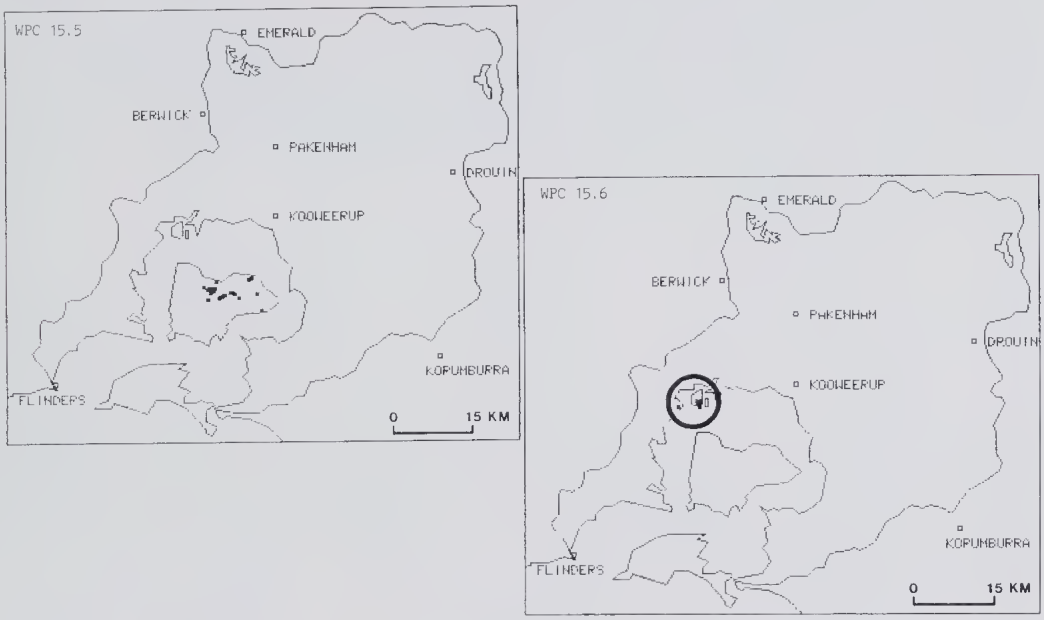
ENVIRONMENT: Depressions or swamps with shallow sands overlying a clay base. Median annual rainfall is between 700 and 900 mm.

ALTITUDE: Mean = 53 m, Highest = 95 m, Lowest = 0 m.

STRUCTURE: Low woodland to Closed-heath

MEAN FLORISTIC RICHNESS: 20 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: Depauperate form of coastal heathland vegetation dominated by the shrub *Casuarina paludosa*.



COASTAL HEATHLAND : SUB-COMMUNITY WPC 15.6

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Leptospermum juniperinum	100	3	Drosera whittakeri	79	1	Hibbertia acicularis	71	1
Banksia marginata	86	1	Epacris impressa	79	1	Lepidosperma neesii	57	3
Gonocarpus tetragynus	86	1	Isopogon ceratophyllus	79	1	Pimelea humilis	57	+
Hibbertia stricta	79	1	Casuarina paludosa	71	1	Xanthorrhoea minor	57	1

NO. OF SITES: 14 (1.4% of total)

DISTRIBUTION: Restricted to Quail Island and two sites near Yaringa.

ENVIRONMENT: Poorly drained near-coastal fresh water swamps on sandy clays. Median annual rainfall is between 700 and 800 mm.

ALTITUDE: Mean = 5 m, Highest = 10 m, Lowest = 5 m.

STRUCTURE: Closed-heath

MEAN FLORISTIC RICHNESS: 22 species per site. MEAN WEED COMPOSITION: No weeds.

NOTES: WPC 15.6 is dominated by low sclerophyllous shrubs and sedges. It is one of two sub-communities within the catchment in which *Lepidosperma neesii* is a character species (the other being WPC 15.2). This sedge is more commonly a component of East Gippsland coastal heaths.

PRIMARY DUNE SCRUB : SUB-COMMUNITY WPC 16.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
*Ammophila arenaria	100	1	Spinifex hirsutus	67	1	*Polycarpon tetraphyllum	67	+
Daucus glochidiatus	100	+	Calocephalus brownii	67	1	Senecio lautus	67	1
Helichrysum paralium	100	1	Cardamine debilis	67	1	Swainsonia lessertiifolia	67	1
Olearia axillaris	100	2	Crassula macrantha	67	+	Tetragonia implexicoma	67	2
Rhagodia baccata	100	1	Crassula sieberiana	67	+	Caryophyllaceae spp.	67	1
Scirpus nodosus	100	1	Dianella revoluta	67	1	Compositae spp.	67	+
Senecio spp.	100	+	*Hypochoeris radicata	67	+			
Leucopogon parviflorus	67	+	Poa poiformis	67	1			

NO. OF SITES: 3 (0.3% of sites)

DISTRIBUTION: Restricted to the south-east coast of Phillip Island. Also occurs at Sandy Point on the mainland (Robin and Parsons 1976).

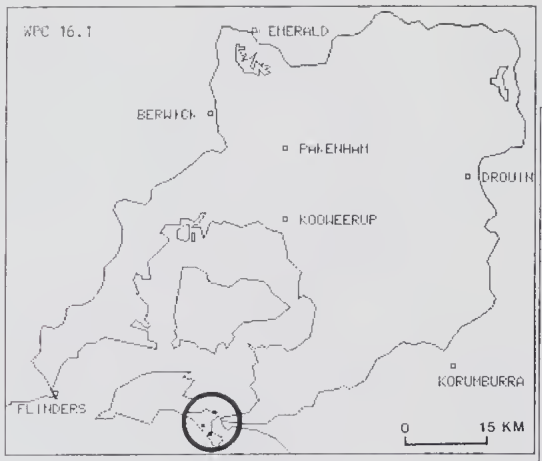
ENVIRONMENT: Exposed embryonic to tertiary sand dunes. Median annual rainfall is 700-800 mm.

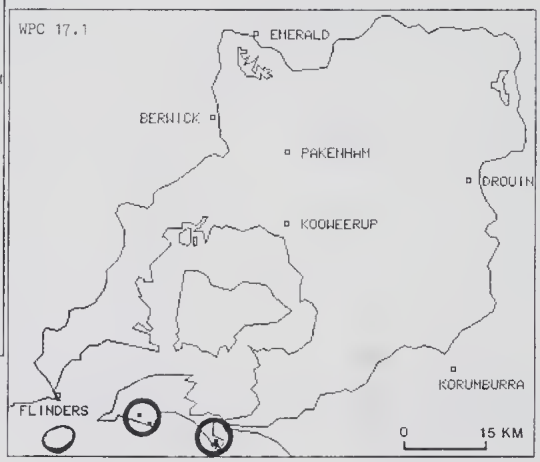
ALTITUDE: Mean = 16 m, Highest = 25 m, Lowest = 3 m.

STRUCTURE: Open-heath

MEAN FLORISTIC RICHNESS: 23 species per site. MEAN WEED COMPOSITION: 19% of species, 19% of cover.

NOTES: The rhizomatous growth habit of some, and extensive root system of most, of the species of this sub-community contribute to the important function of dune stabilization. Protection from strong salt winds afforded by the foredunes is essential for the maintenance of communities further inland. The delicate balance between sand-binding plants and soil structure is, however, readily upset by trampling and this may explain the restricted distribution of this vegetation type - which is otherwise well represented along Victoria's coastline - within the catchment (e.g. GLC 13.1 and EG 20.1 in Forbes *et al.* 1981). A common feature of this vegetation type is the replacement of the native sand-binding grass *Spinifex hirsutus* with plantations of the introduced grass *Ammophila arenaria*.





COASTAL TUSSOCK GRASSLAND : SUB-COMMUNITY WPC 17.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Acaena anserinifolia	100	1	*Sonchus oleraceus	60	+	Senecio lautus	60	1
Poa poiformis	100	3	Calocephalus brownii	60	1	Tetragonia implexicoma	60	1
Scirpus nodosus	100	1	Dichondra repens	60	+	Geranium spp.	60	+
*Holcus lanatus	80	+	*Hypochoeris radicata	60	1			
Dianella revoluta	80	1	Oxalis corniculata	60	1			

NO. OF SITES: 5 (0.5% of total)

DISTRIBUTION: Restricted to the south coast of Phillip Island.

ENVIRONMENT: Coastal cliff areas exposed to intense winds and sea spray, and subject to limiting soil conditions such as a sparse horizon and low organic matter content. Median annual rainfall is 700-800 mm.

ALTITUDE: Mean = 31 m, Highest = 60 m, Lowest = 3 m.

STRUCTURE: Open tussock grassland

MEAN FLORISTIC RICHNESS: 25 species per site. MEAN WEED COMPOSITION: 13% of species, 9% of cover.

NOTES: A sub-community containing grasses, sedges, herbs and, in areas where soil conditions permit, wind-pruned shrubs, which are adapted to the extreme environment of an exposed coast. The shallow, gravelly soil which supports WPC 16.1 is easily disturbed and trampling can have a drastic effect on the vegetation. It is the only sub-community in the Study Area which is dominated by *Poa poiformis*, a tussock grass which is common on undisturbed Victorian coasts and islands of Bass Strait. One site contains the rare species *Cyathodes juniperinum*.

COASTAL TEA-TREE SCRUB : SUB-COMMUNITY WPC 18.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Leptospermum laevigatum	100	3	Lophocolea semiteres	59	1	Senecio lautus	50	1
Leucopogon parviflorus	86	2	Dichondra repens	59	1	Scirpus nodosus	50	1
Clematis microphylla	73	1	Rhagodia baccata	55	1	Daucus glochidiatus	50	1

NO. OF SITES: 22 (2.2% of total)

DISTRIBUTION: Widespread along the coast of Phillip Island and along the south-west coast of the mainland between Sandy Point and Flinders, and at Sandy Point on French Island.

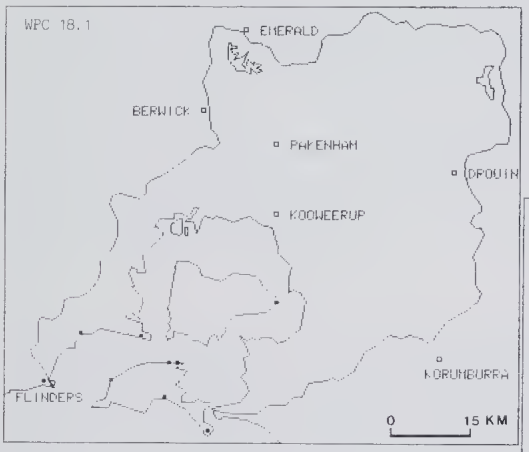
ENVIRONMENT: Calcareous sands in coastal areas which are generally less exposed, and have undergone greater substrate development than sites supporting WPC 16.1 and WPC 17.1. Median annual rainfall is 700-1000 mm.

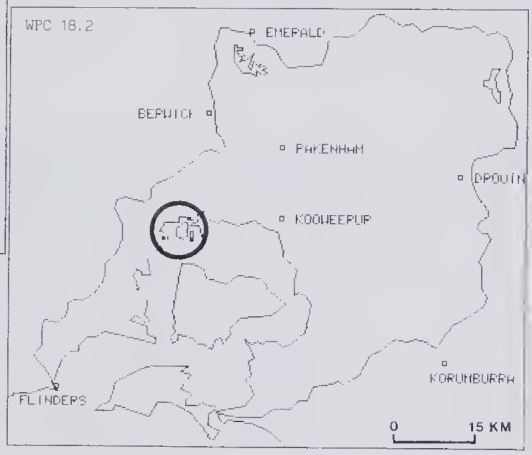
ALTITUDE: Mean = 19 m, Highest = 100 m, Lowest = sea level.

STRUCTURE: Open-scrub

MEAN FLORISTIC RICHNESS: 18 species per site. MEAN WEED COMPOSITION: 11% of species, 8% of cover.

NOTES: This is the best known coastal vegetation near Melbourne - the tea-tree vegetation. In many places *Leptospermum laevigatum* forms such a dense canopy that few other species grow beneath it. In other places the large shrubs *Leucopogon parviflorus* and *Banksia integrifolia* are also present and break up the canopy to increase the growth of understorey species. Many, if not most, sites supporting this sub-community were exploited by settlers for firewood in the early part of the century.





COASTAL TEA-TREE SCRUB : SUB-COMMUNITY WPC 18.2

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Eucalyptus viminalis	100	+	*Hypochoeris radicata	67	+	*Stellaria media	67	1
Leptospermum laevigatum	100	4	Lagenifera stipitata	67	1	Pterostylis longifolia	67	1

NO. OF SITES: 3 (0.3% of total)

DISTRIBUTION: Three isolated occurrences at Yaringa, Cannons Creek and Chinaman Island.

ENVIRONMENT: Flat areas near the coast on deep siliceous sands. Median annual rainfall is between 700 and 800 mm.

ALTITUDE: Mean = 4 m, Highest = 5 m, Lowest = 2 m.

STRUCTURE: Closed-forest

MEAN FLORISTIC RICHNESS: 14 species per site. MEAN WEED COMPOSITION: 13% of species, 7% of cover.

NOTES: An unusual vegetation type of very tall (± 10 m) *Leptospermum laevigatum* in which the scrub layer is absent, and the ground layer is sparse.

These stands are very old and may pre-date European settlement. However, they may have originally contained *Casuarina stricta* and *Banksia integrifolia* which were subsequently removed by the early settlers.

The Chinaman Island site is slightly different from the other two in that *L. laevigatum* is co-dominant with large *Melaleuca ericifolia*.

COASTAL Banksia WOODLAND : SUB-COMMUNITY WPC 19.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Leucopogon parviflorus	100	2	Pteridium esculentum	83	3	Clematis microphylla	67	+
Banksia integrifolia	83	1	Eucalyptus viminalis	67	2			

NO. OF SITES: 6 (0.6% of total)

DISTRIBUTION: Restricted to the south-west coast between Sandy Point and Flinders.

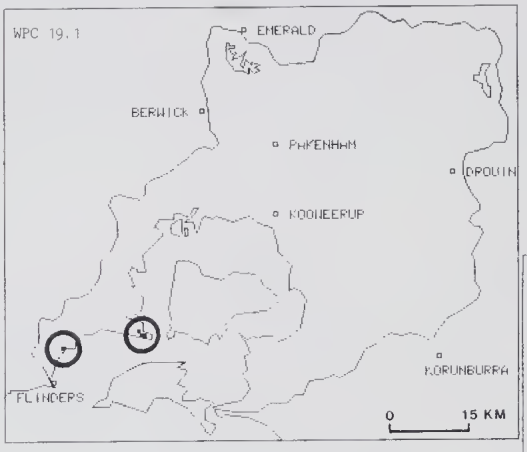
ENVIRONMENT: Calcareous sands in coastal areas which are generally less exposed, and have undergone greater substrate development than sites supporting WPC 16, WPC 17 and WPC 18. Median annual rainfall is 700-800 mm.

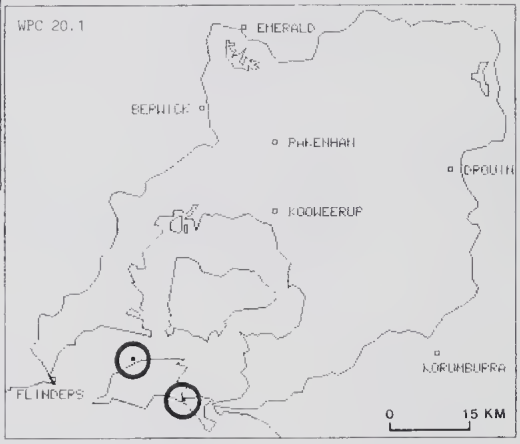
ALTITUDE: Mean = 13 m, Highest = 30 m, Lowest = 5 m.

STRUCTURE: Low-open forest

MEAN FLORISTIC RICHNESS: 17 species per site. MEAN WEED COMPOSITION: 9% of species, 6% of cover.

NOTES: WPC 19.1, which is dominated by *Eucalyptus viminalis*, generally occurs landward of the closely associated WPC 18.1. The understorey species and floristic diversity varies markedly within this sub-community. The high incidence of *Pteridium esculentum* is indicative of frequent burning.
WPC 19.1 has affinities with GLC 12 (Gullan *et al.* 1981) and EG 19 (Forbes *et al.* 1982).





SUB-COMMUNITY WPC 20.1

CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A	CHARACTER SPECIES	% FREQ	C/A
Clematis microphylla	100	+	Melaleuca lanceolata	100	3	*Stellaria media	100	1
*Ehrharta longiflora	100	2	Parietaria debilis	100	1	Tetragonia implexicoma	100	1
Leptospermum laevigatum	100	1	Rhagodia baccata	100	1			
Leucopogon parviflorus	100	1	*Sonchus oleraceus	100	1			

NO. OF SITES: 2 (0.2% of total)

DISTRIBUTION: Few isolated occurrences on Phillip Island.

ENVIRONMENT: In sheltered areas on tuff cliffs or calcareous sand dunes in close proximity to volcanic tuffs or basaltic soils. Median annual rainfall 700-800 mm.

ALTITUDE: Mean = 12 m, Highest = 20 m, Lowest = 5 m.

STRUCTURE: Low-open forest

MEAN FLORISTIC RICHNESS: 21 species per site. MEAN WEED COMPOSITION: 35% of species, 41% of cover.

NOTES: This sub-community is characterised by *Melaleuca lanceolata*, a species of disjunct and limited distribution within the State. However, the pleasant appearance of these trees and the shade afforded by their canopy has led to the severe trampling of many sites by tourists and consequent weed invasion.

REVIEW OF THE INFRASPECIFIC CLASSIFICATION OF DROSERA MACRANTHA Endl.

by

BARRY J. CONN*

ABSTRACT

The subspecific classification of *Drosera macrantha* Endl. is rejected because the two presently recognized subspecies *(viz.* ssp. *macrantha* and ssp. *planchonii)* are morphologically indistinguishable.

INTRODUCTION

N. G. Marchant (Marchant & George 1982) reduced *Drosera planchonii* J. D. Hook. *ex* Planchon to a subspecies of *D. macrantha* Endl. He defined *D. macrantha* ssp. *macrantha* as having shallowly fringed ovate sepals, and ssp. *planchonii* as having deeply fringed, broadly ovate sepals. The two subspecies were recorded as occurring in distinct geographical regions, ssp. *macrantha* in Western Australia and ssp. *planchonii* in south-eastern Australia (refer Marchant & George *l.c.*, 36–38 and maps 34 & 35). A preliminary investigation by myself showed that several collections from Western Australia appeared morphologically indistinguishable from ssp. *planchonii* and so further investigations were carried out.

ASSESSMENT OF MORPHOLOGICAL FEATURES

160 specimens of *D. macrantha* held at MEL were used for an assessment of the taxonomic value of sepal shape and the size of the sepal 'fringe'. Sepal shape was defined using two parameters: (i) sepal length to sepal width ratio, and (ii) the position of the widest part of the sepal relative to the sepal base. The length of the hairs on the distal portion of the sepal margin was used as a measure of the size of the sepal 'fringe'. The hairs on the more basal portions of the sepal margin are usually shorter in both the Western Australian and south-eastern Australian populations of this species. The average of three measurements from each specimen was used for both characters evaluated.

To evaluate the status of the two currently recognized subspecies of *D. macrantha* the Western Australian collections were kept distinct from those of the south-eastern Australian region. The resulting scattergram (Fig. 1) of sepal length to sepal width ratio plotted against the length of the hairs on the distal portion of the sepal margin clearly shows that the Western Australian and south-eastern Australian populations of this species do not form distinct clusters. There is a tendency for many Western Australian specimens to have shorter hairs (less than 0.7 mm long) on the sepal margin compared to most of the south-eastern Australian specimens (mostly at least 0.8 mm long). However the extent of the overlap between the collections from the two regions (Western Australia (0.3-) 0.5-1 (-1.7) mm long *cf.* south-eastern Australia (0.2-) 0.7-1.3 (-2) mm long) is such that any distinction based on this character can not represent natural groupings. There is a similar trend when sepal shape is considered (Fig. 1). Some Western Australian collections tend to have narrower sepals than some south-eastern Australian specimens. However there is a large overlap in the range of sepal width (Western Australian populations 1.3-2.6 (-4.2) mm wide *cf.* south-eastern Australian populations (1.6-) 2-2.6 (-4.6) mm wide).

Although other morphological characters were studied in detail, none were found to be taxonomically useful for distinguishing between the Western Australian and south-eastern Australian populations. The only other distinction between the specimens from these two regions given by Marchant & George (*l.c.*, p. 38) is that the Western Australian populations have a "Stem up to 1.5 m long", whereas those from the

*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria 3141.

Muelleria 5(5): 347-349 (1984).

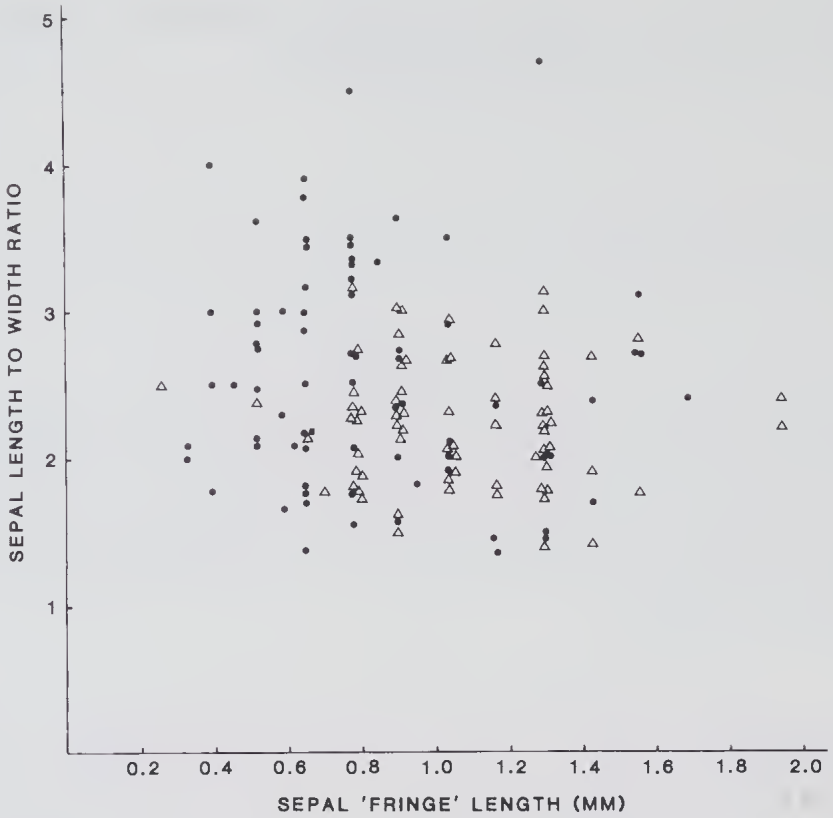


Fig. 1. Scattergram of sepal length to sepal width ratio against sepal 'fringe' length for *Drosera macrantha*. Dots represent Western Australian populations, triangles represent south-eastern Australian populations.

south-eastern region have a "Stem up to 60 cm long". No study of the factors affecting stem length has been made but the taxonomic significance of this character is probably low.

The shape of the sepals has been variously described by different authors (oblong-lanceolate (Endlicher 1837); oblong-obovate (Diels 1906); obovate (Curtis 1956); narrowly lanceolate-ovate (Marchant & George 1982)). Using the shape terminology of Ball *et al.* (1962), I found that the sepals of this species vary from ovate (± = 'lanceolate' of Endlicher and of Marchant & George) to narrowly ovate, or rarely broadly ovate (length to width ratio 1.3-1.4), or obovate to narrowly obovate, or sometimes more or less oblong (length to width ratio (1.3-) 1.8-3.5 (-4.7), (2.9-) 3.5-8 (-9) mm long, 1.3-2.6 (-4.6) mm wide). The apex of the sepal is usually more or less obtuse. Sometimes it is truncate, especially when the sepals are oblong to narrowly obovate. Although the sepals of the Western Australian populations are commonly narrow and those of the Tasmanian populations are usually obovate, the entire range of variation occurs throughout the distributional range of this species.

It is here concluded that the subspecies of *D. macrantha* do not deserve recognition and that *D. planchonii* should be regarded as a synonym of *D. macrantha* without any infraspecific status.

NOMENCLATURE

The synonyms, with the relevant literature, for *D. macrantha* are cited below. The type collection(s) for each taxon, as cited in the relevant protologue, has been included for completeness.

Drosera macrantha Endl. in Endl. *et al.* Enum. pl. 6(1837)*; Lehm. Pl. Preiss. 1:254(1845); Planchon, Ann. Sci. nat. (Bot.) ser. 3, 9:294(1848); Benth. Fl. austral. 2:468(1864); Diels, Pflanzenr. 26:118, figs 37F & 38A-D(1906); Blackall & Grieve, W. Austral. wildfl. 1:177(1954); Marchant & George, Fl. Austral. 8:36–38, fig. 9(1982). TYPE: *Hügel s.n.*, 'Perth ad Swan-River' (W *n.v.*).

D. planchonii J. D. Hook. *ex* Planchon, Ann. Sci. nat. (Bot.) ser. 3. 9: 294(1848); Hook. Comp. Bot. Mag. 1:274(1836) [as 'D. menziesii']; Icon. pl. 1: t.53(1837) [as 'D. menziesii']; J. D. Hook. Bot. antarct. voy. III. Fl. Tasman. 1:29 & 30(1855); F. Muell. Pl. Victoria 1:62(1860) [as 'D. menziesii']; Nat. pl. Victoria, part 1:55 & 56(1879) [as 'D. menziesii']; Key Vict. pl. 1:133(1888) [as 'D. menziesii']; Diels, Pflanzenr. 26:118(1906); Ewart, Fl. Victoria, 552, fig. 227(1931) [as 'D. menziesii']; Curtis, Student's fl. Tasmania 1:186(1956); Black, Fl. S. Austral. 2:390(1963); Willis, Handbk pl. Victoria 2:188(1973). — *D. menziesii* R.Br. var. *albiflora* Benth. Fl. austral. 2:468(1864) [based on *D. planchonii* J. D. Hook. *ex* Planchon]. — *D. macrantha* Endl. ssp. *planchonii* (J. D. Hook. *ex*. Planchon) Marchant, Fl. Austral. 8:38 & 383(1982). SYNTYPES: *Gunn 449*, 'Swan Port', Tasmania (HO, K *n.v.*); *Gunn 5*, 'Port Phillip', Victoria (K *n.v.*); *Witthaker [Wittaker] s.n.*, 'Encounter bay', South Australia (K *n.v.*).

D. macrantha Endl. var. *burgesii* Diels, Pflanzenr. 26:118(1906). — *D. macrantha* var *minor* Benth. *p.p.*, Fl. austral. 2:468(1864). TYPE: *Burges s.n.*, 'Sudwest-Australien' (?B *n.v.*).

EXCLUDED INFRASPECIFIC TAXA

D. macrantha Endl. var. *minor* Benth. *p.p.* = **D. subhirtella** Planchon [refer Marchant & George, *l.c.*, p. 34].
D. macrantha Endl. var. *stricticaulis* Diels = **D. stricticaulis** (Diels) O. Sarg. [refer Marchant & George, *l.c.*, p. 38].

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*Marchant & George (1982) incorrectly cited the prologue as Stirp. herb. hügel 6(1837).

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